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ADVERTISEMENT.

The extension of the scope of the National Museum during the past few years, and the activity of the collectors employed in its interest, have caused a great increase in the amount of material in its possession. Many of the objects gathered are of a novel and important character, and serve to throw a new light upon the study of nature and of man.

The importance to science of prompt publication of descriptions of this material led to the establishment, in 1878, of the present series of publications, entitled "Proceedings of the United States National Museum," the distinguishing peculiarity of which is that the articles are published in pamphlet form as fast as completed, and in advance of the bound volume. The present volume constitutes the thirteenth of the series.

The articles in this series consist: First, of papers prepared by the scientific corps of the National Museum; secondly, of papers by others, founded upon the collections in the National Museum; and, finally, of facts and memoranda from the correspondence of the Smithsonian Institution.

The Bulletins of the National Museum, the publication of which was commenced in 1875, consist of elaborate papers based upon the collections of the Museum, reports of expeditions, etc., while the Proceedings facilitate the prompt publication of freshly-acquired facts relating to biology, anthropology, and geology, descriptions of restricted groups of animals and plants, the discussion of particular questions relative to the synonymy of species, and the diaries of minor expeditions.

Other papers, of more general popular interest, are printed in the Appendix to the Annual Report.

Papers intended for publication in the Proceedings and Bulletins of the National Museum are referred to the Committee on Publications, composed as follows: T. H. Bean, A. Howard Clark (editor), R. E. Earll, Otis T. Mason, John Murdoch, Leonhard Stejneger, Frederick W. True, and Lester F. Ward.

S. P. LANGLEY,
Secretary of the Smithsonian Institution.



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LIST OF ERRATA.

Page 3, the text figure is of *E. camurun*, not *E. tippecanoe*. The anal spines, ventral spines, and snout are incorrect.

Page 157, line 27, for "p. —" read "p. 91."

Page 165, line 18, for "Peropteria" read "Ophictia;" also for "fam." read "fam. 28, p. 93."

Page 220, line 24, for "transversed with" read "transversed by."

Page 347, line 6, for "Platystacidae" read "Bunocephalidae."

Page 349, line 19, for "frow" read "from."

Page 353, line 12, for "*Synodontis*" read "*Sisor*."

Page 353, line 20, insert a period after "filamentosus."

Page 353, line 21, insert a period after "nodosus."

Page 360, line 8, for "*Sargus*" read "*S. argus*."

Page 361, line 11, for "Cottidae, Scombridae" read "Gobiidae."

Page 361, line 12, for "Cotto-scombriformes" read "Gobiiformes."

Page 368, line 32, for "four" read "three and a half."

Page 371, line 6 from bottom, dele "to four."

Page 376, line 10, for "Bidragt," read "Bidrag."

PROCEEDINGS
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FOR THE YEAR 1890.
VOLUME XIII.

DESCRIPTION OF A NEW SPECIES OF LAND SHELL FROM CUBA—
VERTIGO CUBANA.

BY
WM. H. DALL, ..
Curator of the Department of Mollusks.

Vertigo cubana sp. nov.

Testa parva, dextrorsa, rubescente castanea, apice pallida, obtusa; anfr. v convexi, superficies spiraliter striatula, costulis transversis flexuosis ad XXV, concinne clathrati; basis imperforata; apertura campanulata, trilobata, obliqua; singulis dentibus in margine dextro et in basali, duobus in pariete aperturali; max alt. .07; max. lat. .055 poll.

Shell pinkish brown, paler toward the apex, small, short, stout, dextral, five-whorled; apex rather bluntly rounded, sides subparallel, base full and rounded; spiral sculpture of fine striæ, most prominent between the ribs on the last whorl and obsolete on the early whorls; they do not overrun the ribs; transverse sculpture of (on the last whorl about twenty-five) strong, sigmoid, squarish, narrow, elevated ribs, running from suture to suture, and separated by much wider interspaces; these ribs are closer and finer toward the apex of the spire, they resemble when best developed those of *Pupa lyrata* Gould; last whorl subconstricted before the aperture is formed; aperture obscurely trilobate, margin well reflected, whitish; primary lamellæ, except A and E, set rather more deeply in the throat than usual. Formula A C E according to Dr. Sterki's arrangement. The primary A is stronger and more triangular at the aperture than the others, but becomes a thin, narrow, sharp lamella internally; the secondary, 2, does not come so near the aperture as A, but further back is a little higher than the lat-

ter, and the two run parallel like rails on a track, but somewhat irregularly. From the aperture no lamella can be observed on the pillar, but the primary C, which falls short of reaching the margin and is comparatively weak toward the aperture, in the depths of the throat is higher and stronger, forming a prominent, high, thin lamella. The primary E is prominent at the angle of the outer lip, and projects toward A; deeper in it becomes lower and weaker, and still further in it projects in a high triangular plate stronger than any of the others at that depth. There are no indications of any other lamellæ or callosities. The margin of the aperture is set somewhat obliquely to the axis (see Fig. 2). Max. lon. of shell, 1.75; max. diam., 1.37^{mm}.

HABITAT.—Cuba.

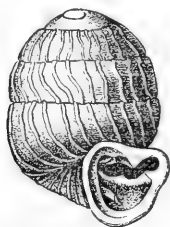


FIG. 1.

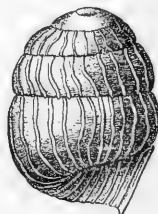


FIG. 2.

FIG. 1.—*Vertigo cubana* Dall, type specimen magnified seventeen diameters, front view.

FIG. 2.—The same, viewed from the side to show obliquity of the margin of the aperture.

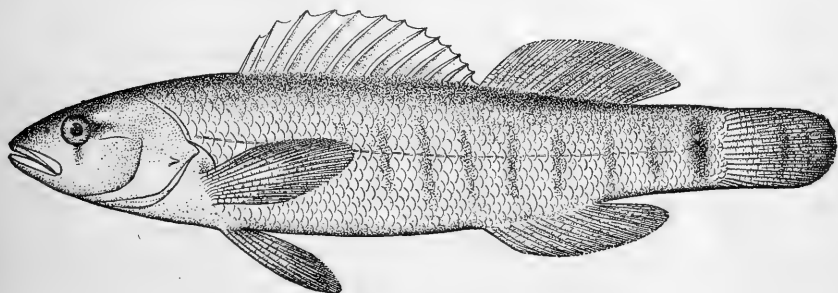
A single specimen of this remarkable little species is in the U. S. National Museum, mollusk register 87645. It was received from the collection of the late Dr. Shurtleff, now belonging to Wesleyan University, Middletown, Conn., and was obtained by him from the late Prof. C. B. Adams, or at least still occupies the tiny glass tube, stopped with sealing-wax, in which Professor Adams secured his minutæ, and a tiny label on which is written "Pupa . . . Cuba" in Professor Adams's well-know chirography. The only species resembling this to my knowledge is *Pupa lyrata* Gould, a native of the Sandwich Islands, which is sinistral and much larger, measuring 2.75^{mm} in length. *P. lyrata* has a distinct though feeble columellar plait or ridge, and it is possible that a more advanced specimen of the Cuban species might possess it, yet the shell appears perfectly mature. The Cuban shell has the transverse ribs strongest on the last whorl, while in *P. lyrata* they are strongest on the upper part of the spire. Notwithstanding these differences these two species evidently belong to the same section of the genus. *P. lyrata* is referred to *Vertigo* by Gould in the "Otia," and Pfeiffer places it in the section *Vertilla* Moquin Tandon, characterized by some peculiarities of the jaw and by a reversed shell, the latter a character of no value. For the present, until the sections of *Vertigo* are more definitely established, it will be sufficient for all purposes to leave our Cuban species under that head without attempting a more precise classification.

DESCRIPTION OF A NEW SPECIES OF FISH FROM TIPPECANOE
RIVER,, INDIANA.

BY
DAVID STARR JORDAN AND BARTON WARREN EVERMANN.

Etheostoma tippecanoe sp. nov.

Type, U. S. National Museum, No. 40080. Allied to *E. jessie* and to *E. cæruleum*. Head, $4\frac{1}{4}$ in length; depth, $4\frac{3}{4}$; D. XII-12, A. II, 7. Scales, 5-50-8, with pores on about 23. Length, $1\frac{1}{2}$ inches.



Etheostoma tippecanoe sp. nov.

Body rather robust, compressed, with deep caudal peduncle; head moderate, with pointed snout; eye small, as long as snout, $4\frac{1}{2}$ in head; mouth large, oblique, the lower jaw somewhat included; maxillary reaching nearly to middle of eye; opercle very short, little longer than snout, its spine strong; cheeks naked, or with one or two scales above; opercles well scaled; breast naked; top of head naked; nape with fine scales; upper jaw not protractile; gill membranes nearly separate; lateral line straight, ceasing under front of second dorsal. Dorsals moderate, slightly connected; anal spines subequal; pectorals shortish, about as long as head; caudal short, subtruncate. Color dark, the scales covered with fine punctulations; body with twelve dark (blue in life?) cross bands, nearly vertical and narrower than the interspaces; the next the last one brightest and broadest; between this and the last two bright spots (red in life?) with a dark one between them, at base of caudal; a black humeral scale; first dorsal dark; second dorsal,

anal, caudal, and pectorals barred; ventrals speckled; three dark streaks diverging from eye. The interspaces on sides were probably more or less red in life.

Four specimens of this interesting little fish were collected by Mr. B. W. Evermann in the Tippecanoe River, at Marshland, Ind. The species is allied to *E. jessie*, differing chiefly in the more pointed head, nearly naked cheeks, and smaller opercle.

REMARKS ON SOME FOSSIL REMAINS CONSIDERED AS PECU-
LIAR KINDS OF MARINE PLANTS.*

BY

LEO LESQUEREUX, COLUMBUS, OHIO.

(With Plate I.)

The fossil remains described below belong to two different geological periods, and are very unlike in their appearance and composition. One of these organisms, the more interesting (Fig. 1, 1a), is like a long flexuous tubular stem embedded in a large piece of hard compact gray limestone, the label attached to the specimen indicating the locality as "Upper Helderberg limestone, Sandusky, Ohio." The others are of much larger size, either (Figs. 2, 3) cylindrical fragments traced in relief upon gray, hard, yellowish sandy shale, of the so-called Erie shale formation, exposed in cliffs bordering Lake Erie near Cleveland, Ohio, and referred by Dr. Newberry to the Portage Group of the Chemung,† or (Figs. 4-9) short, oval, utricular bodies, rounded at one end, bilobate at the other, mostly seen in relief, entirely destitute of any kind of roots, seemingly dropped here and there upon large flattened pebbles or lenticular masses of argillaceous iron ore, locally distributed in the shale. Though all are evidently of the same facies and character they are totally independent, more or less distant from each other, abnormal in form and position, and without recognized affinity to any kind of living plants or animals. They belong to that class of ill-defined fossil remains fitly called problematic organisms by Saporta, and therefore their nature is differently regarded by paleobotanists. By some they are regarded as the remains of marine plants of old types that have been gradually effaced and are now extinct, like those for example which have been generally described as Fucoids; others, refusing to find in them any trace of vegetable nature, even of organization, regard them as the result of mere mechanical mouldings produced by the movement of water or the tracks or burrows of different kinds of animals upon soft muddy surfaces, either near the shore or at the bottom of the sea.

Though apparently of little importance to science, the discussion of the true nature of these fossil remains has been and is still pursued with persistence by some of the highest authorities in vegetable paleontology, and has given occasion to the publication of very creditable and conscientious memoirs; those of Saporta, for example, one upon the fossil Algæ,‡ another upon the problematic organisms of the an-

* This paper was prepared and submitted for publication some months before the death of the author—Editor.

† Report of the Geological Survey of Ohio, vol. 1, Part 1, Geology, 1873, p. 163.

‡ A propos des Algues fossiles, par le Marquis de Saporta. Paris, 1832.

cient seas;* one also by Delgado on the Bilobites and other fossil remains of the Silurian of Portugal;† and still others in opposition to the opinion of these authors, especially the memoirs of Professor Nathorst, of Stockholm, on the tracks of invertebrate animals and their paleontological importance.‡ The first two paleontologists named, admitting the vegetable origin and nature of the fossil remains in question, have supported their opinion by splendid figures and admirably detailed descriptions of these fragments, especially the Bilobites, which they consider as vegetables of the ancient seas; while Professor Nathorst, following an original and quite different method of research, has produced upon sand, soft clay, or muddy matter, by mechanical agency, the tracks of insects, mollusks, crustaceans, etc., the movement of water upon the shores, the action of rain, of currents, etc., traces in relief or impressions very similar in appearance to many of those which have been described by botanists as fucoidal remains, and has presented by photography upon numerous plates the remarkable result of his experiments.

I am not called upon to discuss in this short article the nature of the evidence afforded by these memoirs in support of the conclusions of these authors, as both opinions are legitimate when partially applicable or sustained by facts, while they are in the same way rightly contradicted by others.

In generalizing on a subject like this the evidence is interpreted according to the views of each of the contesting parties, and partly supported by facts unknown or not examined by the others. The student called to determine the nature of as yet unknown fossil remains has to use his own judgment, and to describe as reasons for his opinion the characters on which his determinations are based.

DESCRIPTION OF THE SPECIMENS.

Halymenites Herzeri sp. nov.

Pl. I, Figs. 1, 1a.

Fragment of stem or frond, cylindrical, simple, undulately curved, as flexible in its original state, immersed in the limestone, split lengthwise and exposing its inner structure, which is composed of a tubular, central hollow, filled in its petrified state by amorphous hard calcareous matter, bordered with a thick coating or cortex of less compact cellular matter, intermixed with a large number of black, perfectly round dots, spores, or reproductive gemmules, one-fourth of a millimeter in diameter or less.

The preserved part of the frond is 18^{cm} long, 6^{mm} in diameter; the central (originally hollow?) part 2½^{mm}; the spores, extremely numerous,

* Les organismes problématiques des anciennes mers, Paris. 1884.

† Étude sur les Bilobites et autres fossiles des Quartzites de la base du Système Silurien du Portugal, par J. F. N. Delgado. Lisbonne, 1886.

‡ Om spår af några evvertebrerade, etc., in Koenigl. Svenska Vetenskaps-Akademiens Handlingar, B. 18, No. 7, 1886, [with separate edition of this work translated and abridged in French as "Nouvelles observations sur des traces d'animaux et autres phénomènes d'origine purement mécanique décrits comme Algues fossiles," par A. G. Nathorst. 1886.]

globular, or round-flattened, one-fourth of a millimeter in diameter or less, are irregularly spread, but more abundantly along the borders of the tubule or in the thickness of its peripheric horizontal filaments, but seen also upon the exposed surface of the matter filling the tube.

The fossil fragment is that of an Alga referable by its texture to the *Chordariaceæ* Agardh, an order of the *Melanospermæ* or olive-colored algæ, agreeing in its essential characters with those of the genus *Chordaria* of Agardh, as described in "Nereis Bor. Am.," by Harvey, I, p. 123, as having "*Frond cylindrical, cartilaginous, solid, hollow in the center coated with a pile of radiating horizontal peripheric filaments, spores clavate or obovate arising from the base of the filaments and concealed among them.*" Adding to this the remark in the description of the genus *Halymenites* in Schimper's *Paléontologie Végétale*, Vol. I, p. 193, "*sporangia punctiform, immersed in the texture of the frond,*" the affinity is forcibly recognized. For as seen marked upon the enlarged part of the fossil organism, figured at 1a, even the radiating filaments are observable with the lens as well as the numerous black sporangia.

The specimen is remarkable and of great value, for until now very few fossil remains of marine plants have been discovered with their internal texture in such a state of preservation that its characters were possibly discernible. One or two specimens only of that kind are recorded by paleobotanists.

HABITAT.—Upper Helderberg limestone, Sandusky, Ohio. Collector, Rev. H. Herzer, to whom the species is dedicated.

Cylindrites striatus sp. nov.

Pl. I, Figs. 2, 3.

Frond forking at base in two cylindrical simple branches obliquely diverging, 1 to $1\frac{1}{2}$ cm in diameter; surface striate lengthwise; stria thick, filiform, generally continuous, parallel, straight, but traced like short irregular wrinkles, curved or obliquely serpentine at some places.

Two specimens partly figured represent the species. The branches emerging from an irregularly nodose or tuberculose protuberance, forking near the base, diverge at an acute angle (20° to 25°), are exactly cylindrical and apparently simple. The preserved parts in both specimens, 8 cm long, do not bear any branches, but in specimen No. 2 they are traversed at various angles by other stems, also simple, passing under or above them.

The branches are clearly detached from the surface or merely superposed upon it by the lower face, so that as seen in Fig. 2 the cross section is exactly circular and therefore appears in relief, and the spaces between the stems remain free of deposited matter as deep, irregular concavities. The stems are entirely petrified, the inner part of the cylinder being filled by amorphous matter of apparently the same compound as that of the rock under them, a hard calcareous or argillaceous soft-grained stone mixed with minute scaly shining micaceous particles.

Of these shining scales, observable as well upon the surface or cortical envelopes of the branches as upon the stone whereupon they are superposed, I can not see any in the matter filling the stems. The striæ are mostly regular and parallel, and are in some places here and there inflated, obliquely flexuous or serpentine, much like those covering the surface of *Gyrolithes*, which are beautifully figured by Saporta in his work on the problematic organisms (*Op. cit.*, pls. v and vi). These wrinkles, according to this author, represent in relief a netting of the cells composing the outer cortex of the tube, or the inner cavity remained empty by the disappearance of a vegetable organism of which the character is unknown; for the substance filling the tube is homogeneous, or like that of the stone in which the organisms are embedded. To this ingenious explanation of the origin of the irregular striæ observed upon the surface of cylindrical bodies as inference of their vegetable origin, may be added the presence and peculiar position of small short stem-like bodies, vertically upraised 6 to 8^{mm} above the surface of the stone, by the side of the large prostrate cylindrical remains and evidently of the same nature. Two of these vertical branches are seen in Fig. 3a. They are slightly enlarged toward the base as passing to radicular appendages; their surface is obscurely marked by striæ, and horizontally, 6 to 8^{mm} above the base, their top transversely cut is truncate, marked by a scar like that produced by the rupture of a small branch.

As tending still to evince the vegetable origin of the fossil fragments considered here, it may be remarked that if the bodies, which are exactly cylindrical and apparently contiguous only by a narrow rim to the flat surface upon which they are superposed, are represented in their original position, neither their petrification by penetration of solid materials nor their construction by animal agency, the work itself, the procuring of matter for the composition of the cortex of a tube, can be considered possible.

If *per contra* the specimen represents the lower face of a shale upon which is seen in relief the cast, molded upon the impression of objects of which the original matter has been, after its destruction, replaced by stony substances, how explain the impression of a complete cylinder and its representation in relief or as a cast entirely free of the surrounding matter?

The fossil fragments described above have some likeness, at least in form and size, to those of *Cylindrites rimosus* Heer, Fl. Foss. Helv., p. 115, pl. XLVI, fig. 9. The figures of this species represent cylindrical molds of various sizes, more or less flexuous, not regularly or distinctly striate. Their position relative to the stone on which they occur is not indicated in any way. Heer remarks only that the organized substance of the remains is gone and that their surface, which is narrowly ribbed lengthwise, appears rimose or cracked. Concerning the genus *Cylindrites* of Goeppert, Schimper says that it was established upon

fragments of molds or casts which do not show any characters indicating even approximately the form of the plant to which they belong, and Nathorst remarks, that to the group *Cylindrites* are referred all the fossil bodies more or less regular, cylindrical, simple, or rarely branched, straight or sinuous, or spirally twisted, from one-half to 2^{cm} in thickness, which are supposed to belong to algae. He considers some of them as tracks or borings of some kinds of animals creeping within the deposits of muddy, clayey matter or upon the surface, while others are referable to sponges. Hence the genus has no precise characters, and though I have used the name for the description of tubulose fragments, which in my opinion belongs to marine vegetables, I admit that I do not know to what kind of fucoidal plants described by botanists this fossil may have distinct affinity.

HABITAT.—Portage group, in cliffs bordering Lake Erie, near Cleveland, Ohio. Collector, Rev. H. Herzer.

Physophycus bilobatus sp. nov.

Pl. I, Figs. 4-9.

Fronde utricular, rounded, oblong in outline, strangled above the middle, inflated on one side, compressed, obtusely bilobate at the other, traversed inside by a medial axis emitting bundles of filaments passing toward the borders and apparently constituting the internal structure, sometimes exposed by erosion of the smooth cortical tegument. These bodies are represented in relief upon the surface of large, smooth, concretionary pebbles of soft-grained argillaceous iron ore, upon which they appear superposed and incrustated by one side without trace of roots. They are raised above the surface of the pebbles from 3 to 10^{mm}, according to their size, being convex and therefore gradually higher toward the middle, indicated sometimes by a thin vertical line traced upon the surface.

These bodies, thirty-six in number, are all irregularly disposed at various distances from each other upon fourteen specimens, some of them bearing only one of the organisms, others a few; eight of them, the greatest number on a single specimen, being scattered upon a surface of about 150 square centimeters.

Considering their texture, as far as it can be determined by the traces of curved filaments traversing from the axis to the borders, these fossil remains may be compared to the vesicular or undeveloped fragment of a leaf of *Physophycus marginatus* Schp. Pal. Vég., Vol. I, p. 206,* which as seen in Fig. 4, *l. c.*, seems to be the primary utricle from the development of which are derived the other leaves or forms represented upon the plates. Though the relation between the leaves of *Physophycus marginatus* and the bodies described as *Physophycus bilobatus* is distant, I regard it as an evidence of their organized nature. And indeed those fossils of peculiar forms which appear with mere trifling variations upon a large number of specimens can not have been produced

* *Caulerpites marginatus* Lx., Trans. Amer. Philos. Soc., vol. 13, 1869, p. 314, pl. vii; reproduced as *Taonurus marginatus* Lx., Coal Flora, Second Geol. Survey Penn., P, 1880, p. 7, pl. A, figs. 1-6.

by the work of animals, nor by the water in its motion, nor by a kind of deformation or crystallization in the clay by chemical agency. I see in them odd or exceptional forms of marine plants like those discovered at the base of the coal measures between the Devonian and Carboniferous, five of which are represented in the Coal Flora, *l. c.*, pl. B, figs. 1-8, all organisms whose relations or affinity to any kind of vegetable remains is as yet undiscovered, and which for that reason have been described under the new generic names *Conostichus* and *Asterophycus*. Their reference to marine vegetables has not been contested.

In pursuing my researches for the same purpose of procuring evidence on the real nature of the bodies under consideration, I have represented upon the plate six of them whose essential difference, merely in their size, appears to be the result of a gradual development or of growth, and of their texture, which is an agglomeration of cellular filaments. They seem to have been originally simple globular, vesicular rootless hydrophytes, like globular *Ulvaceæ*, growing or increasing in length, dividing at one end into two incipient small lobes, either inflated or flattened by compression and enlarged as in Fig. 4, the whole body of which measures 2^{cm} broad, 2½ to 3^{cm} long. In Fig. 5 the inflated oblong part is twice as long though of the same width, and the lobes of the same character and composition; the size of the whole organism being 5^{cm} long and 2^{cm} broad. Fig. 6 is altogether broader, but the lower part is represented by a hollow impression, while the upper part or the lobes remain exposed in relief. It is the only one of these numerous fossil bodies of which the place of the lower or inflated part is a concavity as deep as is the prominence in relief of the other specimens. The modification is clearly the result of a casual splitting of the tough leathery tegument of the vesicular part, and the destruction of its internal filaments or cellular matter. The cortical pellicle is seen irregularly folded and crumpled by compression upon the concave surface, like the skin of an emptied bladder. The borders of the pellicle are seen at *b*, and a lacerated part of it at *a*. In Fig. 7 the outlines of the inflated oblong bag are preserved; but part of the tegument being destroyed by erosion it exposes to view the internal organization of the body in irregularly curved bundles of filaments passing at right angles from the axis toward the bodies. This internal organization is still more clearly seen in Fig. 8, which has the texture of the body exposed in its whole length by the more prolonged process of erosion. In Fig. 9 the organism has taken a different form by the addition of a third or intermedial lobe and the narrowing downward of the bladderly part, which leaves the central axis exposed like a pedicel. In this case the basilar inflated part seems to have been absorbed for the formation of the third lobe protruding between the lateral ones. The tegument of the body is obscurely wrinkled, especially in the part covering the lobes, the wrinkles appearing as if produced by the exposure in relief upon the pellicle of the filaments underneath. It is in the same manner

that is explained the appearance of the irregular flexuous filaments covering the surface of the cortex of the tubes of the *Gyrolithes* of Saporta and also of those of *Cylindrites striatus* described above.

These remarks in support of my belief in the vegetable nature of these bodies are not conclusive. Indeed, no positive proof that the so-called problematic organisms represent fossil *Algæ* can be furnished except by a microscopical analysis of their texture. But the *Algæ* are cellular plants, rapidly destroyed by maceration, and therefore their tissue is rarely preserved by the penetration of mineral elements, as it is, for example, by the siliceous matter in the fossilization of vascular plants. It is for the same reason that remains of *algæ*, even in accumulation, can not be transformed into coal, and that as fossils they do not show, except in rare peculiar cases, traces of coally matter; for the cellular compounds of their tissue is, by decomposition of the plants, disseminated as bituminous fluid even under the same circumstances of slow burning, which gradually transforms the woody or vascular tissue into coal. In rare cases only the bituminous elements of the *Algæ* become fixed and solidified. It is, where marine plants of thick tissue or in massive agglomeration become embedded, decomposed, and flattened in compact argillaceous or clayey materials, impenetrable to the fluid produced by decomposition of the plants. The bituminous elements are then gathered in the space formed by the stratification of the clayey materials and then gradually solidified and crystallized into a vitreous hard black matter, pure compact bitumen, much like hard coal. Thin sheets of this matter are often observed in the formation of black shales of the Devonian, sometimes appearing like black spots of different forms, generally as thin as paper and adhering to the shale, sometimes like circular groups of sporangia, more rarely as layers of concrete bitumen, and of a thickness of 2 or 3^{mm}, adhering by one side to the shale vertically split by cleavage into cubical pieces more or less distantly separated from each other. This crystallized bitumen is sometimes attached to a flat surface apparently like a piece of bark, traced by thin vertical lines, irregular in distance, but parallel, even sometimes crossed at right angles by a few other straight striae, probably representing traces of some kind of superficial organization of stems of *Algæ*, but none, as far as I know, distinct or regular enough to offer reliable characters for determination. These flat surfaces, diversely striate, are comparable to the problematic organism figured as *Vexillum* or *Eophyton*, mentioned above.

In cases like this the fossilized bitumen sufficiently proves that these traced surfaces, like the round groups of sporangia, represent marine organisms; but their reference to peculiar groups, genera, even families of *algæ*, remains hypothetical.

HABITAT.—Portage group, in cliffs bordering Lake Erie, near Cleveland, Ohio. Collector, Rev. H. Herzer.

I am unable to discover in the numerous forms traced in relief upon the three forms described below any features or characters in evidence of their vegetable nature.

Nos. 37 and 38.—Large fragments of shale covered upon one face by numerous flexuous linear filaments, mixed and curved in divers ways, varying in diameter from 2 to 5^{mm}, some half cylindrical, others more flattened, traced in the middle by a depression or narrow channel and on the sides by close, more or less regular wrinkles oblique to the axis. Generally the fragments of these linear bodies, some of them 10 to 12^{cm} long, have the same size or equal diameter in their whole length; one of them only seems abruptly narrowed near one of its extremities and there branching at right angles. As the fragments are very numerous, covering the surface in crossing upon each other in many directions, the difference in size, remarked above, may be a mere casual deformation. Their form and distribution correspond to the representation by photography of *Crúziana Bagnolensis* Moriére, in Delgado's *Étude sur les Bilobites*, p. 61, pl. XXVIII-XXX. In their generality they represent different forms of *Chrossochorda Scotica* Schp., figured in Saporta and Marion's "Év. Règ. Vég., Cryptogames," p. 81. According to Nathorst they are merely trails of Gasteropods or Annelids, an opinion already admitted by Hall in *Palæontology of New York*, vol. II, pls. XII and XIII, who has figured the same kind of impressions.

No. 39.—Fragments of linear filiform bodies, much smaller than those of specimens 37 and 38, but of the same external form, much longer, flexuous, turning many times around in the same limited space and passing upon each other without abrupt change of direction. Described as species of *Gyrochorta* by some authors, they are, still more evidently than the preceding, mere traces of worms or small marine animals.

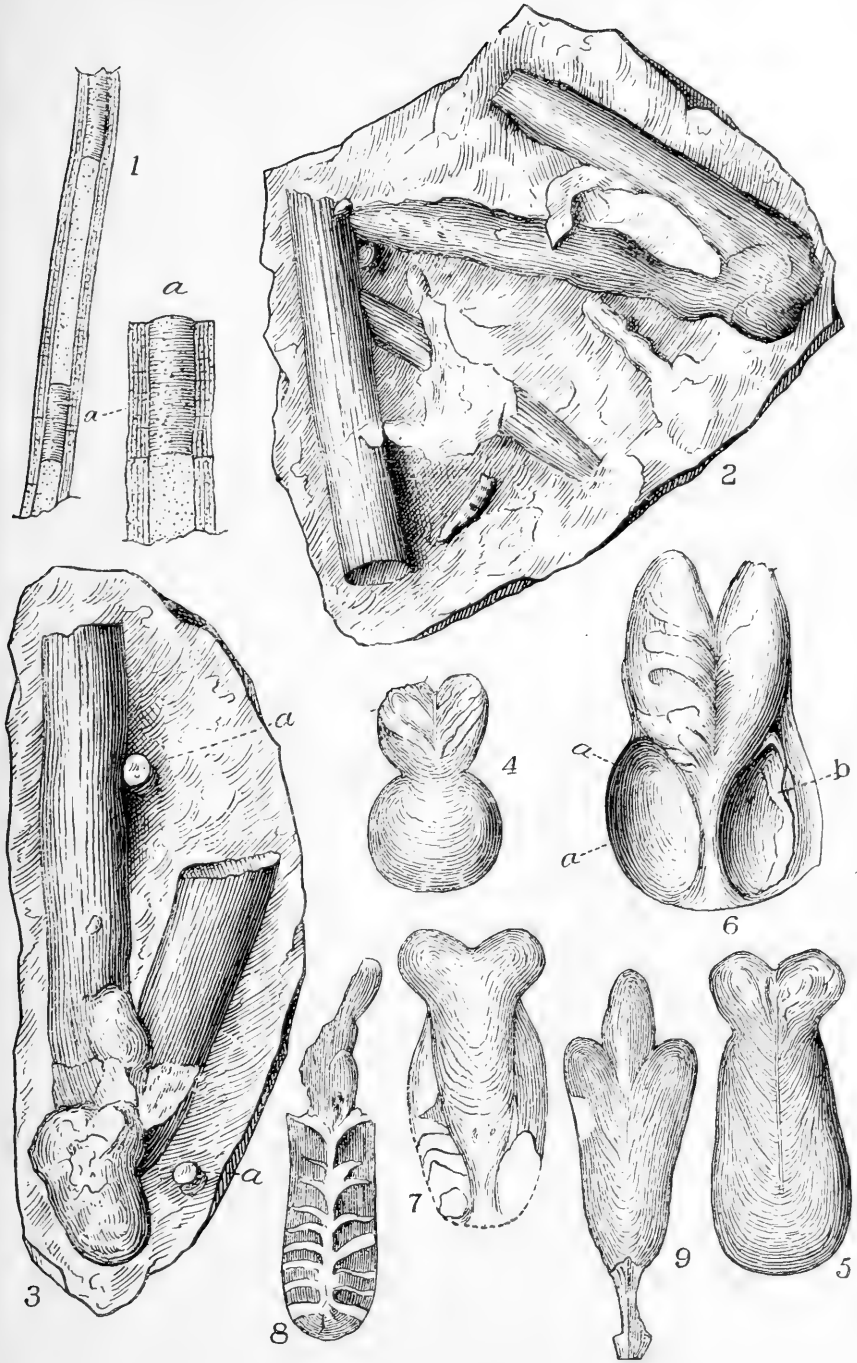
No. 40.—A flat-ribbed or striated fragment like those figured as *Eophyton Morierei* in Saporta et Marion, *Op cit.*, p. 81, fig. B, also figured as *Vexillum Morierei* Sap., "Organ. problém.," pl. XII, fig. 2. It is upon the same slab as No. 39, appearing like a fragment of foreign material of bark of *Calamites*, for example, 2½^{cm} broad, 6^{cm} long, raised about 2^{mm} above the surface of the stone. Its upper face is traced lengthwise by few straight lines or striæ at unequal distances, and by the circular traces of worms or *Gyrochorta* mentioned above.

EXPLANATION OF PLATE.

FIGS. 1, 1a, *Halymenites Herzeri* sp. nov.

FIGS. 2, 3, *Cylindrites striatus* sp. nov.

FIGS. 4-9, *Physophycus bilobatus* sp. nov.



FOSSIL MARINE PLANTS.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COM-
MISSION STEAMER ALBATROSS.

[Published by permission of Hon. Marshall McDonald, U. S. Commissioner of Fisheries.]

No. X.—ON CERTAIN MESOZOIC FOSSILS FROM THE ISLANDS OF ST.
PAUL'S AND ST. PETER'S, IN THE STRAITS OF MAGELLAN.

BY

CHARLES A. WHITE,

Honorary Curator of the Department of Mesozoic Fossils.

(With Plates II, III.)

The fossils which are noticed in this article were collected by members of the U. S. Fish Commission upon the voyage of the *Albatross*, 1887-'88, and submitted to me for examination by the Commissioner, Col. Marshall McDonald. They are all in a bad state of preservation, most of them being fragmentary. I have been able to recognize only two species, one of which is an aberrant form of the Cephalopods, belonging either to the genus *Ancylloceras* or *Hamites*, apparently to the latter. The other is a bivalve shell, having the general aspect of a *Venus*, but which possesses some of the distinguishing features of *Lucina*.

The presence of the Cephalopod just mentioned seems to leave no room for doubt that the strata from which these fossils were obtained are of Mesozoic age, and they are referred to the Cretaceous with little or no hesitation. The shell provisionally referred to *Lucina* seems to have a Tertiary aspect, but assuming that it was found associated with the *Hamites*, it also referred to the Cretaceous. Following are descriptions and figures of the two species which have been recognized:

CEPHALOPODA.

Genus HAMITES Parkinson.

Hamites elatior Forbes?

[Plate II, Figs. 1 and 2.]

Hamites elatior Forbes, Geology of the Voyage of the *Beagle*, by Charles Darwin, p. 265.

The original specimens which were described by Forbes were collected by Darwin at "Port Famine, Tierra del Fuego." They are not figured by Forbes, but from his description they seem to be specifically identical with those which were obtained in the Straits of Magellan.

The species is a large one, the largest fragment in the collection having a transverse diameter of not less than 3 inches ; but it is a smaller one which is figured on Pl. II. All the fragments in the collection seem to be portions of the living chamber, none of them showing the septa or sutures of the same.

CONCHIFERA.

Genus *LUCINA* Bruguiere.

Lucina ? *townsendi* sp. nov.

[Plate III, Figs. 1 and 2.]

Shell large, much inflated when adult, for a species of *Lucina*; umbones moderately prominent; beaks almost terminal; lunule small but somewhat deep; the postero-dorsal portion of each valve laterally compressed and defined from the body of the shell by a deep, long, narrow groove which meets its fellow at the postero-dorsal extremity of the shell. Surface marked by strong lines of growth. In its robust form and the somewhat prominent umbones this shell does not agree with typical forms of *Lucina*, and furthermore its hinge is not known. Its affinity with the Lucinoids, however, is suggested by the distinct dorso-umbonal grooves, its distinct lunule, its depressed ligament, and its marginal outline. The figures on Plate III are of natural size.

The specific name is given in honor of Mr. Charles H. Townsend, who collected the fossils described in this article.

PLATE II.

Hamites elatior ?

FIG. 1. Lateral view of a fragment of the living chamber.

FIG. 2. Outline of transverse section of the same. It is probable that the natural outline was more nearly circular, as the specimen from which it was drawn has been somewhat compressed.

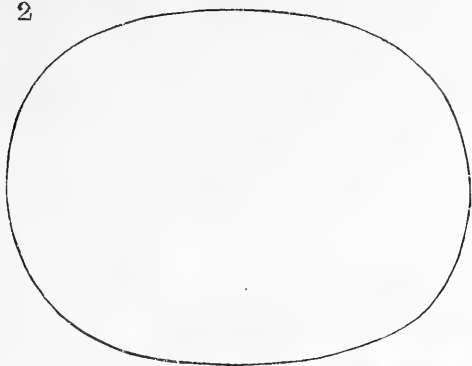
PLATE III.

Lucina ? *townsendi*.

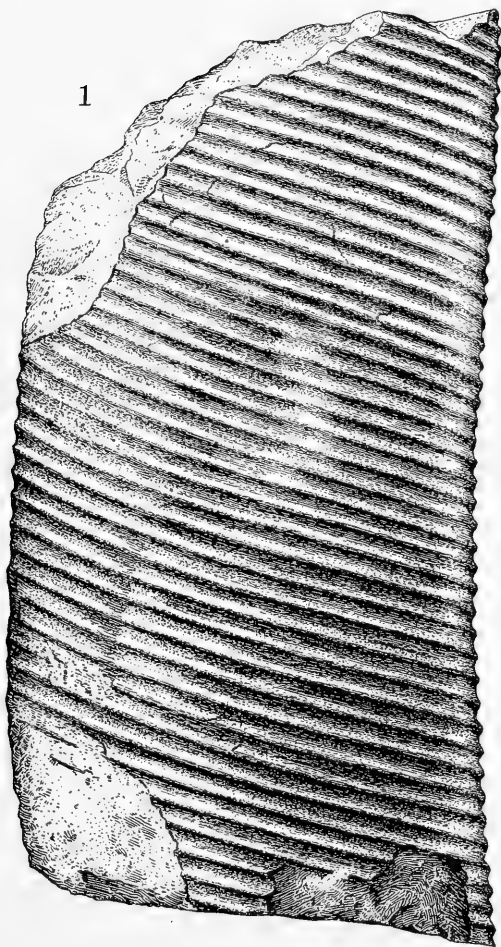
FIG. 1. Lateral view of an adult example.

FIG. 2. Dorsal view of the same.

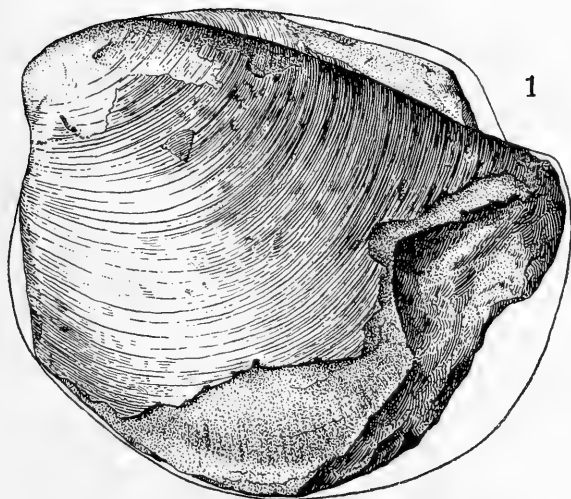
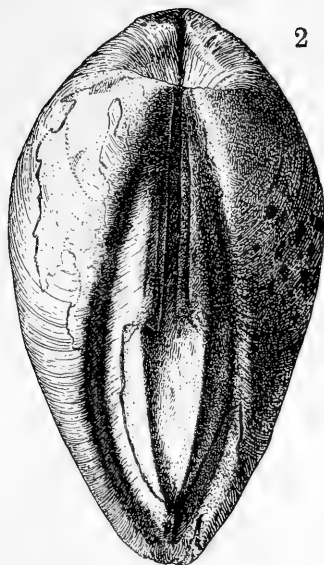
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MESOZOIC FOSSILS FROM STRAITS OF MAGELLAN.



MESOZOIC FOSSILS FROM STRAITS OF MAGELLAN.

NOTES ON THE LEAVES OF LIRIODENDRON.

BY

THEODOR HOLM,

Assistant in the Department of Botany.

(With Plates IV-IX.)

During the spring of 1889, while engaged in studying the germination of some of our native plants, I collected quite a large number of germinating plantlets in the woods about Washington, especially along the Potomac shore. In the pursuit of these studies I found many specimens of our common Tulip-tree (*Liriodendron Tulipifera*), which, however, did not particularly attract my attention, since their germination with the cotyledons above ground showed nothing especially remarkable; nevertheless I collected a number of them and brought them home for closer examination. I now observed, that although their germination did not present anything of particular interest, they showed a peculiar fact in respect to their young foliage-leaves. The two or three leaves developed upon these young plants showed a great similarity among themselves, and at the same time differed from those of the older or full-grown tree. I then began the examination of the foliage of the mature tree, and it was not long before I observed that there was a certain regularity, depending upon the position of the different forms of leaves.

It is a well known fact that there is a great variation in the leaves of our recent *Liriodendron*, not only on the same tree, but even on the same branch, but as this circumstance does not seem to have been much discussed heretofore, it may be of interest, at least to paleobotanists, to describe the *Liriodendron* leaf somewhat carefully. After having collected many fine specimens of the leaves, from very young trees and from the branches of some of the oldest ones in the vicinity of Washington, I began to examine the course of the variation. First, however, I looked at the published descriptions of the tree, but it seems to be a fact so well known that the systematic authors have not thought it necessary to mention it. I consulted Prof. Lester F. Ward about it, but he did not remember where these variations were described by any author, but advised me to study certain paleobotanical publications, and called my attention especially to a paper by Dr. J. S. Newberry,

entitled "The Ancestors of the Tulip-tree,"* and to several other papers important to this study.

If we wished to find a complete account of the variation of the leaves of *Liriodendron Tulipifera*, should we not seek it in a paper in which the author attempted to show its ancestral conditions? But I was disappointed in reading this paper, for, curiously enough, Dr. Newberry does not pay any considerable attention to the recent species. He enumerates and figures some new fossil species, and mentions, though briefly, some other ones described before, but the comparison with the living tree which I was looking for was entirely wanting. On turning to some other authors, for instance, Heer, Lesquereux, Saporta and others, I found descriptions and figures of fossil *Liriodendron* leaves, and I shall now try to give a comparison of these ancient types with the only living species, *Liriodendron Tulipifera* L.

The object of these notes, as will appear later, is to prove that, as far as is known to the author, there is not a greater difference in the foliage between many of the extinct species of *Liriodendron* than between a series of leaves from a very young tree or from a branch of an older one of our recent species. I shall therefore take as a point for discussion the last sentence in Dr. Newberry's paper: "Hence, until more material shall show the simple, ovate, or lanceolate forms to be connected by insensible gradations with others, I must regard them as specifically distinct."

The most rational manner of treating the question of the difference between the fossil and the recent species is to commence the examination with the living plant, of which the most complete material will be always at hand and certainly give the most reliable result. We have then to look at the descriptions given by the different authors in the systematic works. The species, as well as the genus, was first described by Linné in his "Species plantarum," 1764, p. 755, where he described the leaf as "tripartito acris folio, media lacinia velut abscissa." It seems now, however, as if there is some disagreement among authors, who have either considered the leaf as three-lobed, with the middle lobe notched at its summit, or as a regular four-lobed leaf, but with the apex cut off. We shall see that of seventeen authors eight have described it as three-lobed, while the remaining nine have called it four-lobed. The different diagnoses of the leaf are as follows: "Foliis trilobis truncatis" Willdenow;† "leaves three-lobed, with the central lobe truncated" Nuttall;‡ "leaves truncate at the end, with two side lobes" Eaton;§ "leaves divided into three lobes, of which the middle one is horizontally notched at its summit and the two lower ones rounded at the base" Browne;|| "leaves dilated, rounded or sub-

* Bulletin of the Torrey Botan. Club, vol. XIV, No. 1, 1887.

† Willdenow: Species plantarum, vol. II, Pars II, p. 1254.

‡ Ths. Nuttall: Genera of North American plants, 1818, p. 18.

§ A. Eaton: Manual of Botany for North America, 1833, p. 208.

|| D. I. Browne: The trees of America, 1846, p. 25.

cordate at base, usually three-lobed, the middle lobe broad and emarginately truncate" Darlington;¹ "leaves three-lobed, the middle lobe truncate, glabrous" Darby;² "the leaves are divided into three lobes, of which the middle one is horizontally notched at its summit and the two lower ones are rounded at the base" F. A. Michaux;³ "leaves angled, truncated, mostly rounded at the base, somewhat three-lobed, the middle lobe appearing as if cut off, leaving a shallow notch" Chapman.⁴ The leaf has also, as mentioned above, been described as four-lobed by following authors and in this manner: "Foliis abscisso-truncatis, quadri-lobatis" Michaux;⁵ the same diagnosis has been given by Pursh.⁶ "Folia apice truncata, acute quadri-loba, lobis utrinque duobus sinu obtuso lato distinctis" de Candolle;⁷ "leaves cut truncate, four-lobed" Barton;⁸ "leaves four lobed, truncate" Torrey;⁹ "leaves divided into four, pointed lobes, and terminated by a shallow notch, the extremity being nearly square and the middle rib ending abruptly as if cut off" Bigelow;¹⁰ "leaves truncate at the top, four-lobed, resembling a saddle in shape" Loudon;¹¹ "folia truncata, sinuata, quadri-loba" Bentham and Hooker;¹² "leaves with two lateral lobes near the base, and two at the apex, which appears as if cut off abruptly by a broad shallow notch" Gray.¹³

There is no doubt that the diagnosis given by A. Michaux (*l. c.*) is the only correct manner of describing this peculiar leaf, and, as has been shown above, it has been accepted by such authorities as Bentham, Hooker, and Gray. It is, however, to be remarked that Michaux's four-lobed leaf is properly to be understood as a lobed leaf with the summit wanting, or what he called "abscisso-truncatis (foliis)," while it is not correctly described by other authors, who have called the leaf three-lobed with the middle lobe "cut off." We have no leaf, as far as I know, either fossil or recent, of this genus in which we can find any complete middle lobe or anything like the entire leaf of the genus *Magnolia*, so closely allied to our *Liriodendron*; because I do not take the cotyledons into consideration. These are certainly entire, oblong, and tapering at both ends, distinctly but not sharply pointed at their summit,

¹ William Darlington: *Flora Cestrica*, 1853, p. 9.

² John Darby: *Botany of the Southern States*, 1855, p. 212.

³ F. A. Michaux: *North American Sylva*, vol. II, 1865, p. 35.

⁴ A. W. Chapman: *Flora of the Southern United States*, 1883, p. 14.

⁵ A. Michaux: *Flora Boreali-Americana*, 1803, p. 326.

⁶ Fr. Pursh: *Flora Americae septentrionalis*, vol. II, 1816, p. 382.

⁷ A. P. de Candolle: *Prodromus syst. nat. regni. vegetab.*, vol. I, 1818, p. 461.

⁸ William Barton: *Compendium Florae Philadelphicae*, 1818, p. 18.

⁹ John Torrey: *Compendium of the flora of the Northern and Middle States*, 1826, p. 221.

¹⁰ J. Bigelow: *Plants of Boston*, 1840, p. 245.

¹¹ I. C. Loudon: *Trees and shrubs of Britain*, 1875, p. 36.

¹² Bentham and Hooker: *Genera plantarum*, vol. I, 1867, p. 19.

¹³ Asa Gray: *Manual of Botany of the Northern United States*, 5th ed., p. 50.

and show a considerable difference from the mature leaves. A drawing of one of the cotyledons is given on Plate IV, Fig. 1, and a germinating plantlet has been figured by Mirbel in his "Nouvelles recherches sur les caractères anatomiques et physiologiques qui distinguent les plantes monocotylédones des plantes dicotylédones."* But this circumstance that there is a difference between the cotyledons and the mature leaves does not seem to be of particular importance, when we are looking for the primeval leaf of any genus. We know well enough from the numerous contributions on the subject of the germination, how widely different the shape of the cotyledons can be from that of the mature leaves of the same plant, and I will merely call attention to the lobed cotyledons of *Tilia*, the entire ones of *Acer*, the *Umbellifera*, etc.

As to the nervation of the mature leaf of the recent *Liriodendron*, this seems rather to show a four-lobed than a three-lobed leaf, or perhaps it would be better to say a pinnately-lobed than a palmately-lobed. The three-lobed leaf, for instance, of *Sassafras*, so exactly figured in Professor Ward's paper: "The paleontologic history of the genus *Platanus*,"† must probably always be considered as a really palmately-veined and lobed leaf, with the two lateral ribs of the lobes strongly developed and proceeding from the base of the midrib, in pairs. But we quite often find, on the other hand, small leaves of the genus *Quercus* with only one lateral lobe on each side, but such a leaf would never on that account be considered as three-lobed. And I propose to compare the leaf of *Liriodendron* with a lobed leaf of *Quercus*, on account of the nervation as shown on Plate IV, where several forms are figured of full-grown leaves. We see on these leaves that the lateral ribs almost proceed in pairs to the lobes, but not at all from the base of the midrib. The leaf is really feather-veined, therefore pinnately-lobed, when lobes are present. Now as to the varieties of *Liriodendron Tulipifera*, but few have been mentioned and described, namely: "*α acutiloba*: lobis acutis acuminatisque, *β obtusiloba*: lobis rotundato-obtusissimis," both of A. Michaux, and finally a variety *chinensis* Hemsl. The two varieties, described by Michaux, have been accepted by Pursh, De Candolle and Browne, though by the last named with a difference in the nomenclature ("*acutifolia*" instead of "*acutiloba*"), and with Loudon as author, but the description agrees perfectly with that given by Michaux. De Candolle has another variety "*foliis quadri-lobis aut rarius subintegris ovatis apice truncato-emarginatis* = *L. integrifolium hortul.*" but this variety has been considered as identical with Michaux's *obtusiloba* by Loudon. Linné also made a variety "*β. Tulipifera caroliniana foliis productioribus magis angulosis*," which possibly may be the same as Michaux's variety *acutiloba*.

As to the variety *chinensis*, this was discovered in China by Dr.

* Annales du Muséum d'hist. nat., XIII, 1809, Pl. VI.

† Proceedings U. S. National Museum, Vol. XI, 1888, Pl. XXI.

Shearer and described as a new species,* but has later been considered as merely a variety by Hemsley,† and it is very interesting, that we have here an Asiatic representative of *Liriodendron*, hitherto supposed to be confined to our country. Moore (*l. c.*) remarks about this form, that it differs from the typical one in having the leaves more deeply lobed and being glaucous underneath. According to the description, given by Forbes and Hemsley (*l. c.*), there has been observed a certain variation in the foliage of the same tree, since the leaves are either deeply lobed and the lobes very obtuse, or the lobes are very short and very acute. The authors, however, remark that these characters together with the size of the flower, which was a little different from that of the typical form, might possibly be sufficient to rank it as an independent species, but the leaves do not give any distinctive character and the flowers differ only in size. We find, however, very little about the general variation in the foliage of the recent species, for the only author who mentions it is Curtis,‡ who says: "They [the leaves] vary greatly in the division of their lobes." In the figure of the tree, given by F. A. Michaux (*l. c.*), there is, however, a leaf with two pairs of lobes, one of which has a short tooth at its base, while, as was stated, the most common form seems to be merely four-lobed; Bigelow § mentions, that "in the large leaves the two lower lobes are furnished with a tooth or additional lobe on their outside." Finally Heer || has given a very interesting note on the foliage of the recent *Liriodendron* as follows:

Die untersten Blätter der Zweige haben beim lebenden Tulpenbaum häufig keine seitlichen Lappen und sind vorn gegen die Ausbuchtung zugerundet, während die obern Zweigblätter die bekannten grossen, vorn zugespitzten Seitenlappen haben und der mittlere Lappen zu beiden Seiten der Ausrandung in spitzen Ecken endet. Von den ungelappten, grundständigen Blättern zu diesen scharf gelappten obern finden sich zahlreiche Uebergänge. Ich habe Taf. XXIII, Fig. 1, ein zweiggrundständiges, ungelapptes Blatt abgebildet, welches den ungelappten der Kreideart sehr ähnlich sieht; an demselben Zweigstand weiter oben Fig. 2, bei welchem nur ganz schwache, seitliche Lappen vorhanden sind, wie bei *L. Meekii primævum*, während die meisten Blätter des Baumes die gewöhnliche, scharff gelappte Form zeigten. Der lebende Tulpenbaum zeigt daher dieselbe Polymorphie der Blätter, wie die Kreideart und steht dieser sehr nahe. Indessen sind die ungelappten Blätter der lebenden Art viel breiter und kürzer, manche fast kreisrund, am Grunde nicht in den Stiel hinablaufend; der mittlere Lappen ist am Grund niemals verschmälert und die Lappen sind aussen in der Regel in eine Spitze auslaufend.

It seems therefore that Heer has understood the recent *Liriodendron* perhaps better than any one else!

If we now consider the figures on Plates IV to IX, all of which represent different stages of growth of *Liriodendron Tulipifera*, collected along

* Moore: Description of some new Phanerog, coll. by Dr. Shearer, at Kiukiang, China. (Journ. of Bot. n. s. iv, 1875, p. 225).

† F. B. Forbes and W. B. Hemsley: An enumeration of all the plants known from China proper, Formosa, Hainan, Corea, etc. (Journ. of Linn. Society, XXIII, No. 150 1886, p. 25).

‡ Wm. Curtis: Botanical Magazine VII, 1794, p. 275.

§ I. Bigelow: American Medical Botany 1818, p. 109.

|| Oswald Heer: Flora fossilis arctica VI, 1882, p. 89.

the shore of the Potomac and in the Smithsonian Park, we must wonder not a little that systematic authors have mentioned so few of these forms. We see here the most "insensible gradations" from the entire to the deeply-lobed leaves. We see the orbicular form in Fig. 5, the obcordate in Figs. 6, 7, and 8, the approximately bilobed in Figs. 16, 31, and 41, and the large variation in the upper margin of these small leaves, more or less notched, as for instance in Figs. 11, 13, 16, etc., or almost horizontal, as in Fig. 17, and, farther, how there is a weak, but quite distinct, attenuation of the blade into the petiole, as in Figs. 6 and 7. And if we examine the other forms with the lobes more or less developed, we shall find quite a large number of variations from Figs. 11, 15, and 17, to the more distinctly lobed leaves, as Figs. 18, 19, and 20, and finally the large leaves, Figs. 2, 3, and 4. We find here another kind of variation, in regard to the depth of the sinuses, merely shallow in Figs. 24 and 25, or very deep as in Figs. 23, 26, 27, 28, 29, and 30. And farther, as stated in the description of the small leaves, the upper margin varies very much in regard to its sinus, deep as in Figs. 22, 24, 39, and 40, or in a much smaller degree as in Figs. 3, 23, 25, 27, and 30. Finally, it must be remarked that the sinus at the base of the blade shows quite a large variation in its depth, but I have not found a case in the larger leaves where the blade tapered into the petiole.

As to the varieties, I have obtained rich material from a single tree cultivated in the United States Botanical Garden under the name of "*integrifolia*," and I suppose this corresponds to Michaux's variety "*obtusiloba*." Leaves from this tree are figured on Plate VIII, Figs. 32 to 37, and these also differ among themselves, ranging from the small, obcordate leaf (Fig. 37) to the more obtuse one, Fig. 36, with the upper margin almost horizontal in contrast with the leaf, Fig. 37, where a deep depression is to be observed. The approximately roundish form, Fig. 33, was the most common on this tree, of which, however, several leaves, as Fig. 32, showed two distinct teeth at the upper margin, corresponding to the upper lobes of the normally developed leaves; and moreover I observed not a few with an incipient dentation at the base and at the middle part of the blade, as shown in Fig. 34. The base showed here the same kind of variation as mentioned above in the typical forms. The other variety, "*acutiloba*" Michaux, is unknown to me, but it is possible that the small leaf, Fig. 23, and the larger ones, Figs. 26 to 30, show a similar form. They represent, however, not a variety, but merely a young state of the typical tree. The small leaf, figured on Plate VI, Fig. 23, has been taken from a plant, 1 foot high, of which the age was almost two years, and all the leaves on this specimen had this same shape. The larger leaves, Figs. 26 to 30, belonged to a mere shrub, no more than 5 feet high, of which the leaves had either the same deeply lobed form, or, as shown in Fig. 31, the almost obcordate outline. It is to be supposed that this form may not be constant, and as the shrub gets older and attains a larger size the leaves will gradually acquire the

normal shape. This is, however, only a supposition, but as mentioned above, the leaf shown in Fig. 23 was from a very young plant, of which I observed many in the same locality, all of which were similar.

If we look now at Plate IX, which represents a part of the foliage of a shoot of the year and developed in the axil of the large leaf, Fig. 38, we shall see, as stated in the explanation of the plates, that Fig. 41 is the first and oldest one of this branch, after which followed a nearly normal four-lobed one, only a little smaller than usual; after this (Fig. 40), somewhat irregular, and still later two normal ones, both of the same shape as Fig. 39, which was the next youngest; the youngest leaf of this branch had again the same shape as that in Fig. 41; in short, the oldest and the youngest leaf on the same branch showed an entirely different form from the intermediate ones, of which the form has been taken as the normal one for our *Liriodendron Tulipifera*, viz: "the four-lobed leaf." It is to be pointed out that instead of the four-lobed leaves it is not uncommon to find leaves with six or even eight lobes, like teeth, as shown in Figs. 3 and 4. The fact that the oldest and youngest leaf on the same branch can differ so much from the other ones seems to be almost constant for the full-grown tree and especially on the lateral branches; it was at least the case with a very large number of branches, which I examined for that purpose. And if we examine very young specimens of our *Liriodendron*, only five months old, we shall certainly see a still greater variation in the young foliage. In some of these not less than five different forms were to be observed in six leaves! The first leaf after the cotyledons showed the shape as given on Plate V, Fig. 10, after this followed another one like Fig. 11, after this two, like Fig. 12, and then two four-lobed ones, the youngest of which showed the form as in Fig. 25, while the preceding was almost like Fig. 23. In general the first four or even five leaves on the very young Tulip tree have the same curious form as the oldest and youngest on the branches of the full-grown tree. This kind of variation in the foliage of many other trees and even in herbs is not uncommon, and it may certainly be considered as a constant character for many plants.

What then is the principal character of the recent *Liriodendron*-leaf, and what characters are to be looked for by the paleobotanists, when identifying fossil leaves, supposed to belong to the genus *Liriodendron*? There is nothing more striking in the leaf than the notch at its apex, which, as we have seen in the plates, is to be observed in all the leaves, excepting Fig. 5, both large and small, whether they are lobed or not. And if the paleobotanists do not find a completely preserved leaf, or at least the apex of it, then it will certainly be a question, whether or not they have the true *Liriodendron* before them, for I do not see any essential difference in the lobes alone nor in the partial nervation, which should be so characteristic as to guide the observer in identifying a fossil *Liriodendron*, if he had not the summit of the leaf. The lobes, considered by themselves, are not very different from those of many

other plants, as for instance, species of *Acer* and *Aralia*, especially if the palmate nervation of these is not to be seen distinctly, which a small part of a lobe might not be able to show. And as to the smaller leaves, the obcordate ones, these are, when they occur as fossils, even more misleading. Leaves with the apex emarginate and of an obcordate form occur so often in the other families as the only typical form of the leaf or leaflet, that it would be more natural for the paleobotanist to think of such families rather than of such a genus as the *Liriodendron*. And their nervation is, in proportion to their size, rather indistinct and far from characteristic; they are regularly feather-veined.

But, still, as will be shown later, several fossil leaves of this obcordate shape have been identified as belonging to *Liriodendron*, whether correctly or not is another question, but why should the ancient types not show at least a similar kind of variation, as does the recent one? There is a peculiar circumstance connected with Dr. Newberry's *Liriodendron oblongifolium*, *L. quercifolium*, and *L. simplex* (l. c.). As the author remarks, the leaves of these three species are proportionally longer than those of the recent species. This seems to be characteristic of several of the other ancient forms, and is a point of great interest, especially because I believe, we may trace it in the recent leaf. There is, namely, in the leaf of *Liriodendron Tulipifera* a short point in the middle of the notch which is an elongation of the midrib, and I have observed this feature in all the leaves I have examined, of both old and young trees. This prolongation of the midrib might then show a rudiment of a longer midrib, that is, the leaf may formerly have been longer and then for some reason have decreased to its present size. It might, however, be objected to this supposition that it very often occurs, that such a point is to be found in leaves, and especially very commonly in the obcordate leaflets of many *Leguminosæ*, where we are not entitled to presume a reduction in length of the leaf. I am well aware of this, but there is another fact that must be considered, namely, that the nervation of the leaflets, pointed and obcordate or with the apex of the blade notched as in *Liriodendron*, in *Hamatoxylon*, *Colutea*, and others, is somewhat different from that of such forms of the recent Tulip-tree. For even if the *Liriodendron*-leaves and the *Leguminosæ*-leaflets are feather-veined, and generally show the same relatively coarse reticulation, yet while the nerves of the *Leguminosæ* leaflets are almost parallel to each other, this is not always the case with *Liriodendron*. Just beneath the upper margin of the leaf of *Liriodendron Tulipifera* is to be observed one pair of very short and rather indistinct ribs, and these proceed almost horizontally from the midrib, while the other ones, at least in the smaller leaves, form an acute angle with the midrib. Might this pair of ribs not have shown an additional pair of lobes, when the leaf was longer, and are they not to be supposed to have always been present in the elongated midrib? This would at least be a great help to the correct understanding of the long leaves

of the supposed *Liriodendron oblongifolium*, *quercifolium*, *simplex*, and others.

Now as regards the fossil leaves, belonging to the genus *Liriodendron*, all of them have been found either in the Cretaceous or in the Tertiary formation. They represent certainly several quite well-distinguished forms, but whether they represent a corresponding number of species is rather doubtful, at least, if we will compare them with the numerous variations, which, as stated above, occur even on the same tree, the only recent species of our flora. These supposed species are:

- Liriodendron acuminatum* Lesqx.
- Liriodendron Celakowskii* Velensk.
- Liriodendron cruciforme* Lesqx.
- Liriodendron Gardneri* Sap.
- Liriodendron giganteum* Lesqx.
- Liriodendron Hauerii* Ettings.
- Liriodendron laramiense* Ward.
- Liriodendron Meekii* Heer.
- Liriodendron Meekii*, var. *genuina*.
- Liriodendron Meekii*, var. *Marcouana*.
- Liriodendron Meekii*, var. *mucronulata*.
- Liriodendron Meekii*, var. *obcordata*.
- Liriodendron Meekii*, var. *primæva*.
- Liriodendron oblongifolium* Newb.
- Liriodendron pinnatifidum* Lesqx.
- Liriodendron Procaccinii*, Ung.
- Liriodendron Procaccinii*, var. A, *Helvetica*.
- Liriodendron Procaccinii*, var. B, *acutiloba*.
- Liriodendron Procaccinii*, var. C, *obtusiloba*.
- Liriodendron Procaccinii*, var. C, (1) *subattenuata*.
- Liriodendron Procaccinii*, var. C, (2) *rotundata*.
- Liriodendron Procaccinii*, var. D, *incisa*.
- Liriodendron quercifolium* Newb.
- Liriodendron semialatum* Lesqx.
- Liriodendron simplex* Newb.

besides the Tertiary, considered as identical with our recent *Liriodendron Tulipifera* L.

We have here fourteen species, with, in all, eleven varieties enumerated of a genus, of which but one is still existing, properly indigenous in North America and China. We shall see later that, while some authors have not hesitated to consider the different forms as species, others have preferred to describe several of them as merely varieties. The geographical distribution of the Tulip-tree was certainly wide in the Cretaceous age, when it existed as far north as Greenland, and in the Tertiary formation it occurred in several parts of Europe from Iceland as far south as Italy. It is not strange then that a genus, scattered throughout many lands during two geological epochs, should have been represented by different forms, even specifically distinct. On the other hand, it must not be forgotten that there is very often to be observed a certain difference in the same plant when we compare its representatives from different countries with varied

climates. I recall for instance the American variety of *Castanea vesca*, the variety *populifolia* of *Betula alba*, the variety *Canadensis* of *Taxus baccata*, and others, of which the typical forms are indigenous in Europe; and even among weeds we have several examples of that kind of variation, influenced by differences in climate and soil; as, for example, *Alisma Plantago* var. *Americana*, *Veronica Americana* but slightly different from the European species *Beccabunga*, the American varieties *sinnuata* and *integrifolia* of *Lycopus Europæus*, and the numerous varieties of the *Gramineæ* from the most widely separate countries the world over.

And if the plant shows also a liability to variation in its foliage, as does our Tulip-tree, might not such kind of variation be brought about in a somewhat different manner, depending on climatological or terrestrial conditions? I do not think it unnatural to suppose so. But a variation in this manner or as the above mentioned of a more proper kind will not be considered as anything but a simple variation, at least not until the changes of the specific characters have increased so much after a very long space of time that the former variety becomes a species, a new type. And in the same manner the varieties might be supposed to belong to the original type, so that a number of apparently distinct forms must be reduced to one. Do not the numerous fossil *Liriodendron*, *Sassafras*, *Liquidambar*, *Aralia*, etc., favor that supposition? There is, if we will now regard the fossil leaves of *Liriodendron*, a great analogy with those of the living species, and the agreement is so striking, that it seems rather hard to distinguish most of them as true species, especially so when we are familiar with the recent forms. Therefore has Heer in his "Flora fossilis arctica," in the chapter entitled "Flora der Atanekerdruk"* preferred to consider some above-enumerated forms as merely varieties of the species *L. Meekii*, and of that reason, as he says (*l. c.*):

Ich bringe diese Formen zu einer Art, weil 1) so unmerkliche Uebergänge zwischen demselben stattfinden, dass keine sichern Grenzen zu ziehen sind; 2) dieselben Formen in der obern Kreide von Nebraska und Kansas vorkommen wie in Grönland, wie ein Blick Tafel XXIII Fig. 3-6 zeigt, wo ich diese amerikanischen Blätter zur Vergleichung mit denen Grönlands abgebildet habe; 3) auch der lebende Tulpenbaum uns einen ähnlichen Formenkreis von Blättern zeigt, etc., etc.

We can not but agree entirely with him, when we regard the series of leaves figured in his *Flora fossilis arctica* (*l. c.*) on Plates XVIII, XXII, XXIII, and XLV. Among these leaves is Dr. Newberry's species *primævum*, and it seems very curious that this author should so differ from Heer, since he says (*l. c.*, p. 4) not only that this species is quite different from Heer's *L. Meekii*, but even that there are no connecting links between them. It is now to be remarked, that the mentioned leaves, figured by Heer, are from widely separated localities, namely the variety *primæva* from the Disco island in Greenland and from Kansas, the variety *genuina* from Nebraska, while the two others,†

* Oswald Heer: *Flora fossilis arctica*, VI, Pars II, 1882.

† *Ibid.*, (*l. c.*), Plate XXII, Figs. 12 and 13.

considered as identical with this, are found in the lower Atanekekdlluk in Greenland. All the other varieties are either from this locality or from Asuk and Isunguak in Greenland, but nevertheless Heer did not find any reason for separating them, on the contrary, he found "insensible gradations" between them, and it seems that it is especially in regard to the understanding of the intergrading forms that Dr. Newberry does not agree with Heer.

What then, is the difference between Dr. Newberry's two leaves of his species *L. primævum* and *L. Meekii*, both from Nebraska, when compared with those called *L. Meekii* var. *primæva* and *genuina* of Heer obtained from Greenland? I do not think there is any difference in the size as far as concerns the variety *genuina*, and in the other one, the variety *primæva*, the leaf from Greenland is somewhat defective, but shows, nevertheless, the emarginate summit and a little more than the half part of the blade, and this leaf does not differ more from Dr. Newberry's drawing than most of the variations I have figured from the living tree. Both of them show a somewhat rounded base, as if there was a tendency toward forming a basal lobe, and at the superior margin there is a distinct and roundish lobe. The nervation is entirely the same. The two forms *primæva* and *genuina* are by Heer united with the species *Meekii*, and it seems to be done so with the best reason; I would merely object to consider them as two different varieties, since the only difference is to be found in the number of lobes, there being two pairs in *genuina* and only one, or rather one pair of distinct lobes and another pair very obtuse, forming an expansion at the base of the blade of *primæva*. Do we not find a similar variation among some of the leaves from the living tree? I will merely call attention to a leaf, Plate VI, Figs. 19 and compare it with another one, Plate V, Fig. 11. It seems to me that we have here a very good analogy in regard to this question. If we examine the leaf on Plate V, Fig. 17, which is from the same young tree as the first one, Fig. 19, we must certainly wonder that Dr. Newberry was unable to find any intergrading forms.

If we now consider the other varieties of *L. Meekii*, figured by Heer (*l. c.*), in his Plates XXII, XXIII, and XLV, we shall then again find a great mutual agreement. These leaves are almost entire or approximately obcordate, especially the variety *obcordata*, Plate XXIII, Fig. 4 (*l. c.*). The difference between these forms is very slight and limited, almost wholly, to the relative proportions of size. The variety *obcordata* shows this characteristic shape, while the leaves of *Marcouana* are longer and narrower, with the base of the blade tapering into the petiole. The third one, *mucronulata*, seems to be closely allied to the variety *Marcouana*, but shows a small point at the end of the midrib, a character, which has also been shown, however, in the leaf, Fig. 5, Plate XXII (*l. c.*), of *Marcouana*. This point seems to be analogous to the

rudimentary prolongation of the midrib, as I have mentioned above and figured in the leaves of the living tree. It seems, then, as if we have the same fact here, that the leaves show an original longer-leaved type. But, owing to the shape of the notch in these three varieties, whatever this is, more or less deeply and sharply sinuate, Heer did not consider this circumstance as being of any essential importance, since he united a form as Fig. 13a on Plate XLV (*l. c.*) of *Marcouana* with another one, Fig. 3 on Plate XXIII (*l. c.*), of the same variety, and he has certainly considered these two as identical with the best reason. For if we look at the small leaves, Figs. 6, 10, and 16 on Plate V, all borne on living trees, we shall find the same manner of variation. But I hardly consider these three forms as "varieties," in consequence of the numerous gradation forms, which I have illustrated, and will again call attention to some of these figures. In regard to the relative proportions of length and breadth there is a series of gradations from Figs. 35 and 36 to Figs. 16 and 41, and we can see the same in regard to the depth of the notch at the apex of these leaves. I do not think it would be too hazardous to suppose Heer's varieties as merely forms, belonging to trees or branches of some different age, either very young or perhaps more mature. But Dr. Newberry objects even here, because Heer has regarded his *L. primævum* as identical with such obcordate leaves of *L. Meekii*, as the last mentioned three varieties. Dr. Newberry remarks (*l. c.*, p. 4), that "indeed the probabilities are against it, since no intermediate forms have been found, and none of the panduriform leaves of *L. Meekii* have been obtained from Greenland, where obovate, entire or emarginate leaves similar to those given the above names (*Phyllites obcordatus* and *Leguminosites Marcouanus*) do occur, and also many of the emarginate, oblong-ovoid, or lanceolate leaves, which I have called *Liriodendron simplex*."

It is now to be remembered, as mentioned before, that such obcordate leaves may occur, and indeed do commonly occur, together with leaves of the typical form on the same tree. I consider it rather as accidental that none of the panduriform leaves of *L. Meekii* have yet been discovered in Greenland, and it is strange that Doctor Newberry does not see any gradation forms in the Greenlandish leaves of *L. Meekii*, figured by Heer on Plate XXII, Figs. 12 and 13, and farther on Plate XVIII, Fig. 4c (*l. c.*).

Massalongo is another author with the same view in regard to the variation or rather the occurrence of different forms of a fossil *Liriodendron* species. We see in the Plates of his "Flora Senigalliese" * a series of leaves of a species which he has referred to *L. Procaccinii* Ung. This species, which was first described by Unger,† is characterized as follows: "*Liriodendron* foliis trilobis, lobo medio maximo truncato—emarginato, lobis lateralibus obtusis vel acutis integerrimis, nervis

* Massalongo: Flora Fossile del Senigalliese, 1859, p. 311.

† Fr. Unger: Genera et species plantarum fossilium, 1850, p. 443.

secundariis pinnatis subsimplicibus." Four varieties of this species have been enumerated by Massalongo:

A. *L. Procaccinii* v. *helvetica*.

B. *L. Procaccinii* v. *acutiloba*.

C. *L. Procaccinii* v. *obtusiloba*, (α) *subattenuata*, (β) *rotundata*.

D. *L. Procaccinii* v. *incisa*.

The variety *helvetica* was first considered as a good species (*L. helveticum*) by Heer,* but after seeing the figures of *L. Procaccinii*, he agreed perfectly with Massalongo in referring it as a variety of this.

If we now turn to the drawings of this variety,† given by Heer, we shall see a very striking agreement with our recent species; indeed, it is rather difficult to find any essential differences. But the leaf, figured by Heer (Fig. 6) shows, moreover, that the blade tapers into the petiole in a somewhat larger degree than we find in the recent species, and this seems to be characteristic of some of the other varieties of *L. Procaccinii*. There is, however, in Heer's *Uhrwelt der Schweiz* (1879) a drawing of a leaf (Fig. 223), which has been identified as *L. Procaccinii*, where there is a distinct sinus at the inferior margin of the leaf instead of, as mentioned above, the blade tapered into the petiole. Heer's remark‡ about this leaf from Iceland, collected by Japetus Steenstrup, is very interesting. He calls attention to the presence of five lobes, but does not think it correct, however, to separate it from the leaves of *L. Procaccinii*, collected by Senegaglia and Eriz, even if these do not show more than three lobes. He mentions the fact that the leaves of our recent Tulip-tree very often show five lobes or sometimes no lobes at all, therefore he does not consider the number of lobes as a character of much importance. Now, in regard to the systematic position of this leaf from Iceland, Heer has remarked not only that there is a great accordance between this and the other leaves of the same species from the continent, but even that these are clearly allied to the living species. There is another leaf considered as identic with *L. Procaccinii*, and figured by Heer in his *Flora fossilis arctica*,§ of which the margin seems to have been entire, without lobation, and if the identification be correct, since the fossil is very poor, *L. Procaccinii* has then shown the same variation as the recent, with the lobes wanting, and I should then compare this form with the leaves figured on Plate VIII, Figs. 33, 36, and 37.

In regard to the other varieties of *L. Procaccinii*, described in *Flora del Senigalliese*, we see here on Plate VII, Fig. 23, a leaf of *acutiloba*, the lobes of which are certainly very acute, but does not seem to differ from the variety *Helvetica* in any other respect, and might possibly correspond to Michaux's *acutiloba* of the recent species, at least, as a sim-

* Oswald Heer: *Flora Tertiaria Helvetiæ*, III, 1859, p. 195.

† *Ibid.*, Vol. I, Plate CVIII, Figs. 6 and 6b, and *Flora Fossilis Arctica* I, 1868, Plate XXVII, Fig. 5.

‡ *Ibid.*, *Flora Tert. Helv.* III, 1859, p. 319.

§ *Ibid.*, Vol. I, 1868, Plate XXVI, Fig. 7b.

ilar form, though with the exception that the blade tapers distinctly into the petiole in the leaf figured by Massalongo. And the next variety, *obtusiloba*, figured on Plate XXXIX, Figs. 3 and 5 *l. c.*, shows again the same kind of variation which occurs so often in the foliage of *L. Tulipifera*, with the lobes more or less obtuse, an approach to the variety *obtusiloba* described by Michaux. The two subvarieties *subattenuata* and *rotundata* (Plate XXXIX, Figs. 3 and 5 *l. c.*) are distinguished by their blades tapering into the petiole or not. The last variety, *incisa* (Plate XXXIX, Figs. 4 and 6 *l. c.*), shows a rather deep notch, but that is the only difference, and this seems to correspond to the leaves I have figured on Plates VI, Fig. 26, and IX, Fig. 40. Furthermore, Ettingshausen* has described a species *Liriodendron Hauerii*, from a leaf of which, however, only the lower part is preserved and shows that the blade tapers into the petiole, and that there are two pairs of relatively strong lateral ribs, but without any lobes, since the margin of the leaf is entirely wanting. The author sees, nevertheless, in this poorly preserved fossil a difference not only from *L. Tulipifera*, but also from *L. Procaccinii*. Another species is *L. Gardneri* Sap., which has been mentioned by Saporta,† and this leaf does not seem to differ in any degree from the recent, at least not from the leaves figured on Plate VII, Figs. 26, 27, 29, 30. Saporta compares this form with the above-mentioned variety *chinensis*, recently discovered in China. It is very interesting to see this leaf of *L. Gardneri* figured together with three other leaves, but representing *L. Procaccinii* from Iceland, Eriz, and Meximieux, since these four leaves illustrate, although in a small degree, the variation in the foliage of our living Tulip-tree. The same author has also, together with Marion, in their "Recherches sur les végétaux fossiles de Meximieux,"‡ described leaves of *L. Procaccinii*, some of which represent quite large leaves, especially Figs. 1 and 2 (*l. c.*), but unfortunately very defective, so that the lobes are not very distinct, but seem, however, to have been somewhat obtuse. The two leaves, Fig. 3 and 5 (*l. c.*), are, on the contrary, preserved very well, and show two very obtusely lobed leaves, and here is to be observed the rudimentary prolongation of the midrib. The last fossil European species of *Liriodendron*, *L. Celakovskii*, has been described by Velenovsky in his "Flora der Boehmischen Kreideformation,"§ though with little success, since, according to the figure, it may never have belonged to any species of *Liriodendron*. It seems, therefore, quite curious to see the following remark of Velenovsky, concerning this leaf: "Von dem lebenden Amerikanischen *L. Tulipifera* L. unterscheidet sich *L. Celakovskii* durch die form, obwohl der Habitus und die Nervation in höchsten Grade uebereinstimmt," because

* Constantin von Ettingshausen: Die fossile Flora des Tertiär-Beckens von Bilin, III, 1869, Plate XLI, Figs. 10 and 10 b.

† G. de Saporta: Origine Paléontologique des arbres cultivés ou utilisés par l'homme, 1888, p. 266, Fig. 1.

‡ Archives du Muséum d'histoire naturelle de Lyon, I, 1872, Pl. xxxiii, p. 271.

§ J. Velenovsky: Flora der Boehm. Kreideform. in Beiträge zur Paleontologie des Oesterreich-Ungarns und des Orient, III, 1883.

the nervation of this leaf is so entirely different from what we have seen of the recent and fossil species of *Liriodendron*, since the leaf, figured by Velenovsky, shows a typical palmate nervation, which is never to be observed in the true genus. It is a regular three-lobed leaf, of which the middle lobe is a little emarginate.

These fossil leaves of the European and Greenland Tulip-tree, which we have considered, have exhibited the same kind of variation in the leaves or foliage as our recent species. But it seems, as I have pointed out above, that the leaves of *L. Procaccinii* have been usually attenuated a little at the base, rather than showing the roundish form, which is the most frequent in the recent type, and this character might probably be sufficient in distinguishing them as specifically differing from, although closely allied to, our recent species. Another character is, as has been observed by Heer, that some fruits found together with the leaves of the variety *Helvetica*, were much smaller and differed in several other respects from those of the recent type. We will now examine the American representatives of the ancestral forms of *Liriodendron*.

Several contributions have been published upon these ancient types by Lesquereux, Newberry, and Ward, and several species have been enumerated by these authors as belonging to this genus. Léo Lesquereux has described *L. intermedium*,* *L. giganteum*, *L. acuminatum*, *L. cruciforme*, *L. semialatum*, and *L. pinnatifidum*, of which the last five have been mentioned in his "Report on the recent additions of fossil plants to the Museum collections."† The author, unfortunately, has figured only two of these six species, but his descriptions are sufficiently clear to give a correct idea of the shape of these leaves.

The first species, *L. intermedium* (*l. c.* Pl. XX, Fig. 5), is a large leaf which seems to have been deeply four-lobed, with the characteristic notch at its apex, but the inferior part of the blade, as well as the outer portion of the lobes, are entirely wanting. It probably represented a form analogous to that shown on Plate VII, Figs. 26 to 30, but apparently with narrower lobes. The other figure, given by Lesquereux in his Cretaceous Flora, is of *L. giganteum* (*l. c.* Pl. XXII, Fig. 2), which shows only a mere lateral lobe of a very large leaf. He mentions, however, in his Report (*l. c.*) that a beautiful entirely preserved leaf has been found of this species, of which the distance between the lower pair of lobes is indicated as being 20^{cm}. The lower lobes are oblong, obtuse, and very broad (6^{cm}), while the superior lobes are shorter, slightly turned upwards, and joining the lower ones in an obtuse sinus at a short distance of 2^{cm} from the midrib. This description shows a form entirely differing from all those hitherto mentioned, and combines as a parallel the leaves figured on Plate VII, Figs. 26 to 30, with the very obtusely lobed form figured on Plate VIII, Figs. 32 to 34.

* Léo Lesquereux: Contributions to the fossil flora of the Western Territories. Part I. The Cretaceous Flora, 1874, p. 93.

† Bulletin of the Mus. of Compar. Zoology at Harvard College, VII, No. 6, 1881, p. 227.

The next species, *L. acuminatum*, is a small-leaved form, of which the two pairs of lobes were only 1^{cm} broad, linear, and acuminate, all curved upwards. It might represent a true species, if it did not belong to a young tree, for instance of *L. intermedium*, of which, as mentioned, the lobes were very narrow with a deep sinus, and there is a possibility that the lobes, or at least the upper one, have been directed upwards. A similar form has been described as characteristic of *L. cruciforme*, but the leaves of this species are large, the upper lobes broad and at right angles to the midrib; the lower lobes were narrow and turned upwards, a form that corresponds very closely to a leaf figured on Plate VII, Fig. 28. *L. semialatum* had merely one pair of short, rounded lobes at the base of the blade, and these were curved upwards and enlarged into an obovate or spatulate entire lamina.

I hardly think that we have any leaf in our recent species corresponding to this, unless the small, almost entire leaves, figured on Plate V, Figs. 7, 9, 10, 13, etc., might represent a form of an almost similar shape; but the author does not indicate any size of this peculiar leaf, nor any indication of the proportional length and width of the lobes. The last species, described by Lesquereux, is *L. pinnatifidum*, of which only a single leaf has been found, showing, as remarked by the author, the general *facies* of a *Liriodendron*, but subalternately trilobate on each side. The only character of this form should then be that the lobes were not opposite, and we might possibly have an abnormally developed leaf, similar to that, figured on Plate VI, Fig. 24, of which the lobes are to be called "approximately alternating." The top of the leaf was, however, broken, so that the true character of a *Liriodendron*, the notched apex, was wanting, and it is therefore a question as to whether the identification has been correct. It is interesting to see the manner in which Lesquereux has considered these six species. It would seem, though, as if he were not unwilling to consider them merely as varieties, perhaps not of one, but of a few species. His remark that the local distribution of the leaves may be relied upon to give some directions for the separation of species is very precise; but, on the other hand, our knowledge of the very distribution of these types is proportionally far from sufficient. Some leaves have only been found in Nebraska and Minnesota, some others in Kansas, but that seems only to show that they have occurred there; by no means that they have not existed in many other localities, and possibly even together. Another question is that there is a probability that we might consider them as local varieties of one or several species. It seems to me, that even if the species described by Lesquereux are mutually different, then we have seen above a similar variation in the foliage of but one species, and that the recent one. It may not be too hazardous to draw some conclusions from the living species, and suppose that these ancient American types have shown a liability to variation in the same degree as our recent form. We have, in regard to that conclusion, a leaf called *Liriodendron laramiense* by Professor Ward and found in the Laramie

Formation, the age of which has been considered as Upper Cretaceous. This leaf is figured in Professor Ward's "Types of the Laramie Flora,"* and shows, even if the upper part is wanting, a form so much like the leaves I have figured on Plate VIII, Figs. 36 and 37, that I do not see any difference at all, as far as concerns the preserved part of it. The margin seems to have been entire and the nervation accords with this variety in all details.

Three other species have been described by Dr. Newberry (*l. c.*), namely: *L. oblongifolium*, *L. quercifolium*, and *L. simplex*, collected in the Amboy clays—Middle Cretaceous—of New Jersey and Long Island. These three forms are large leaves, being deeply-lobed in *L. quercifolium*, shortly lobed in *L. oblongifolium*, and almost entire margined in *L. simplex*. The two first mentioned show a variation analogous to the recent form and the last one is very much like the leaves of very young trees of our living species. *L. oblongifolium* was a very large-leaved form, of which the leaves were 6 to 8 inches long and 4 to 5 inches wide, and, according to the figure in Dr. Newberry's paper, Plate LXI, Fig. 1, there are four teeth or very short, acute lobes on one side of the leaf. The other half is broken, but shows two lobes which are not quite opposite those on the other side. This leaf has, then, been subalternately lobed or rather dentate. There is a distinct notch at the apex of the blade, and the base does not taper into the petiole, so that it accords very well with the leaf of a true *Liriodendron*, but it may be a question whether to consider it as a species or merely as a variety. It looks so very much like the variety from the United States Botanical Garden that although it is far from my intention to connect it with the recent type, I can but regard it as a variety of a form with more deeply lobed leaves, or in any case as something corresponding to our recent form. The leaf, figured on Plate VIII, Fig. 34, shows a somewhat similar shape having three teeth, which are a little shorter than those of *L. oblongifolium*. In regard to the occurrence of this species, it has been found together with *L. quercifolium*, figured by Dr. Newberry (*l. c.*, Plate LXII, Fig. 1), and this seems to be a very interesting circumstance. This species, *L. quercifolium*, has four pairs of long acuminate lobes, and the size of the leaf was almost the same as indicated for *L. oblongifolium*, but did not attain the length nor width of larger specimens of this. That is the same case that I have observed in the recent typical form and the variety from the Botanical Garden, and it is possible that we have, to support this conclusion, an analogous variation before us, rather than two distinct species. It may not be denied, if we will compare them with the above-mentioned leaves of the recent type and the variety, that there is a very good accordance, and in that manner, that *L. quercifolium* should be the species and *L. oblongifolium* its variety. But it is, on the other hand, difficult to say whether Dr. Newberry's third species, "*simplex*," is a *Liriodendron* or not, at least according to the figures given by him (*l. c.*), since the nervation is so entirely differ-

* Bull. of U. S. Geol. Survey, 1887, p. 102, Plate XLVIII, Fig. 2.

ent from that of the true *Liriodendron*—leaves of the same relative shape. I am inclined to believe that the drawings have not been made with sufficient care and that the leaves, merely in regard to the outlines alone, belonged to a large-leaved *Liriodendron*. They may not represent a true species but may be considered as leaves of younger trees of some species with which they have been found associated, for example *L. quercifolium*. We should, then, have a better illustration of one of the ancestors of the Tulip-tree, the typical form, represented by *L. quercifolium*, a variety "*oblongifolium*," and finally the same kind of variation in the foliage as has been described in our recent tree, represented by the form "*simplex*."

We have now regarded a series of fossil leaves which have been identified as having belonged to species different from the recent, but it seems, however, as if the true *Liriodendron Tulipifera* had existed before in the Pliocene formation. A few years ago some leaves of a *Liriodendron* were discovered in the Altai Mountains, which have been described by Schmalhausen* as identical with our recent species, and a figure of one of these leaves shows the superior margin with the shallow notch and a lobe, just as it is in the typical form of *L. Tulipifera*. It is a discovery of great interest, since there is but a very small difference between this leaf and *Liriodendron Procaccinii* var. *helvetica* from the Tertiary formation of Switzerland and Iceland.

If we will now consider these fossil leaves by themselves we shall see that the majority are lobed with acute or obtuse lobes and that there is on the other hand a number of which the lobes were probably wanting, as it seems according to the defective fossils, or the leaves show a more or less obcordate shape. They may be arranged in three groups according to these characters, namely:

I. Leaf lobed.

A. Lobes acute.

- L. acuminatum* Lesqx.
- L. cruciforme* Lesqx.
- L. Gardneri* Sap.
- L. intermedium* Lesqx.
- L. oblongifolium* Newb.
- L. pinnatifidum* Lesqx.?
- L. Procaccinii* var. *Helvetica* Heer.
- L. Procaccinii* var. *acutiloba* Massal.
- L. quercifolium* Newb.
- L. Tulipifera* L.

B. Lobes obtuse.

- L. giganteum* Lesqx.
- L. Meekii* var. *genuina* Heer.
- L. Meekii* var. *primæva* (Newb.) Heer.
- L. Procaccinii* var. *incisa* Massal.
- L. Procaccinii* var. *obtusiloba* { *rotundata* } Massal.
- { *attenuata* }
- L. semialatum* Lesqx.

* Ueber tertiäre Pflanzen aus dem Thale des Flusses Buchtorma am Fusse des Altaigebirges. Palæontographica, xxxiii, 1887.

II. Leaf apparently ovate without lobation.

L. laramiense Ward.*L. Procaccinii* Heer (Pl. XXVI, Fig. 7 b, l. c.)

III. Leaf obcordate, more or less oblong.

A. With rudimentary prolongation of the midrib.

L. Meekii var. *mucronulata* Heer.

B. Without any prolongation of the midrib.

L. Meekii var. *Marcouana* Heer.*L. Meekii* var. *primava* (Newb.) Heer.*L. Meekii* var. *obcordata* Heer.*L. Procaccinii* Ung.*L. simplex* Newb.(Leaf, of which the outlines are unknown: *L. Hauerii* Ettingsh.)

There is, however, another character besides the above mentioned, and this is whether the base of the blade is horizontal or tapering into the petiole, the last of which seems to be especially characteristic of the obcordate leaves, but also varies. We find namely in *L. Meekii*, var. *mucronulata* one leaf with the true obcordate shape, while another one has the inferior margin of the blade distinctly horizontal, but in all the other ones of Group III the blade tapers into the petiole. We find the same kind of variation in the lobed leaves, as, for instance, the varieties *Helvetica* and *acutiloba* of *L. Procaccinii*, and farther, the varieties *primava* and *genuina* of *L. Meekii*, while the base of the blade is almost horizontal in the recent species. This fact does not seem to speak in any absolute favor of a correct identification of the fossil leaves with such a distinct tapering form of the blade into the petiole, and as pointed out above there is good reason for considering some of the obcordate leaves as belonging to plants of a quite different family, namely, if we compare them with leaflets of the *Leguminosae*. But we must then see the articulation, and this very probably has been indistinct, since there is no trace to be observed on any of the numerous figures given of these fossil leaves.

What form then, may be supposed as the original one of the *Liriodendron*-leaf? I am inclined to think that we can conclude nothing positively in regard to the hitherto known fossil leaves identified as *Liriodendron*, and it is especially the presence of the rudimentary prolongation of the midrib, observed not only in the recent species but also in some of the fossil leaves, which gives us the greatest difficulty, because we are entitled to conclude from this circumstance that the leaf has not only been longer and with a larger number of lobes, but also with an apex corresponding in size and shape to the lobes. There is, as it seems to me, the apparently entire leaf of *L. laramiense* and some of the obcordate leaves of the other species, which are of the greatest interest. We have but to elongate the midrib of these a little and we will obtain either an obtuse or acuminate leaf, corresponding to the genus *Magnolia*, and I myself am not unwilling to suppose such a form as proper to the ancient type of the Tulip-tree. The identification of

these *Magnolia*-like leaves would certainly be very difficult or perhaps even impossible, and I do not think it too hazardous to suggest that some of these leaves have already been discovered, but identified and described as *Magnolia* or possibly referred to other genera.

U. S. NATIONAL MUSEUM, November, 1889.

EXPLANATION OF PLATES.

Liriodendron Tulipifera L.

PLATE IV.

- FIG. 1. A cotyledon, four times natural size, reduced one-third.
 2. A typical leaf of an old tree, two-thirds natural size.
 3. A typical leaf of the same tree, two-thirds natural size.
 4. A typical leaf of the same tree, two-thirds natural size.

PLATE V.

(All natural size.)

- FIG. 5. Leaf of a plant, five months old; No. 1 after the cotyledons.
 6. Leaf of a plant, five months old; the youngest one.
 7. Leaf of a plant, five months old; No. 3 after the cotyledons.
 8. Leaf of a plant, five months old; No. 1 after the cotyledons.
 9. Leaf of a plant, five months old; No. 3 after the cotyledons.
 10. Leaf of a plant, five months old; No. 1 after the cotyledons.
 11. Leaf of a plant, five months old; No. 3 after the cotyledons.
 12. Leaf of a plant, five months old; No. 2 after the cotyledons.
 13. Leaf of a plant, five months old; No. 4 after the cotyledons.
 14. Leaf of a plant, five months old; No. 4 after the cotyledons.
 15. Leaf of a plant, five months old; No. 2 after the cotyledons.
 16. Leaf of a plant, five months old; No. 4 after the cotyledons.
 17. Leaf of a plant, five months old; No. 3 after the cotyledons.
 The leaves Figs. 7, 14, and 16 are from the same plant.
 The leaves Figs. 10 and 11 are from the same plant.
 The leaves Figs. 12 and 17 are from the same plant.

PLATE VI.

(All natural size.)

- FIG. 18. Leaf of a plant, five months old; No. 4 after the cotyledons.
 19. Leaf of a plant, five months old; No. 4 after the cotyledons.
 20. Leaf of a plant, five months old; No. 5 after the cotyledons.
 21. Leaf of a plant, five months old; No. 6 after the cotyledons.
 22. Leaf, the next oldest one, of a branch from an old tree.
 23. Leaf, the next youngest, of a plant, two years old.
 24. Leaf, the youngest one, of a branch from an old tree.
 25. Leaf, the next oldest one, of a branch from an old tree.
 The leaves Figs. 9 and 18 are from the same plant.
 The leaves Figs. 15 and 19 are from the same plant.
 The leaves Figs. 22, 24, and 25 are from the same tree.

PLATE VII.

(One-third natural size.)

- FIG. 26. Leaf taken from a mere shrub.
 27. Leaf taken from the same shrub.
 28. Leaf taken from the same shrub.
 29. Leaf taken from the same shrub.
 30. Leaf taken from the same shrub.
 31. Leaf the oldest one, of a branch of the same shrub.

The leaves Figs. 26 to 31 have all been taken from the same shrub in the wood on the shore of the Potomac.

PLATE VIII.

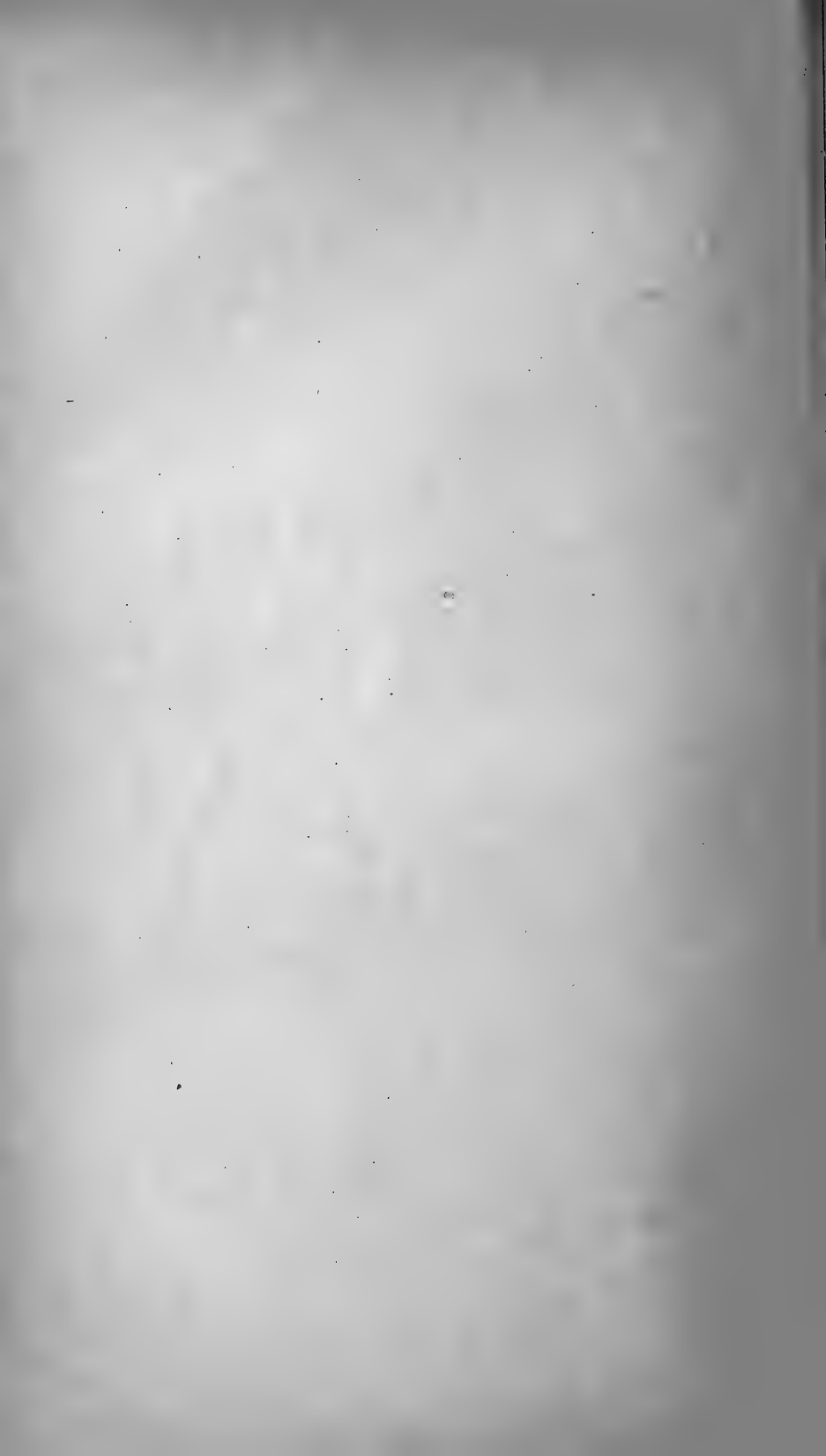
(One-third natural size.)

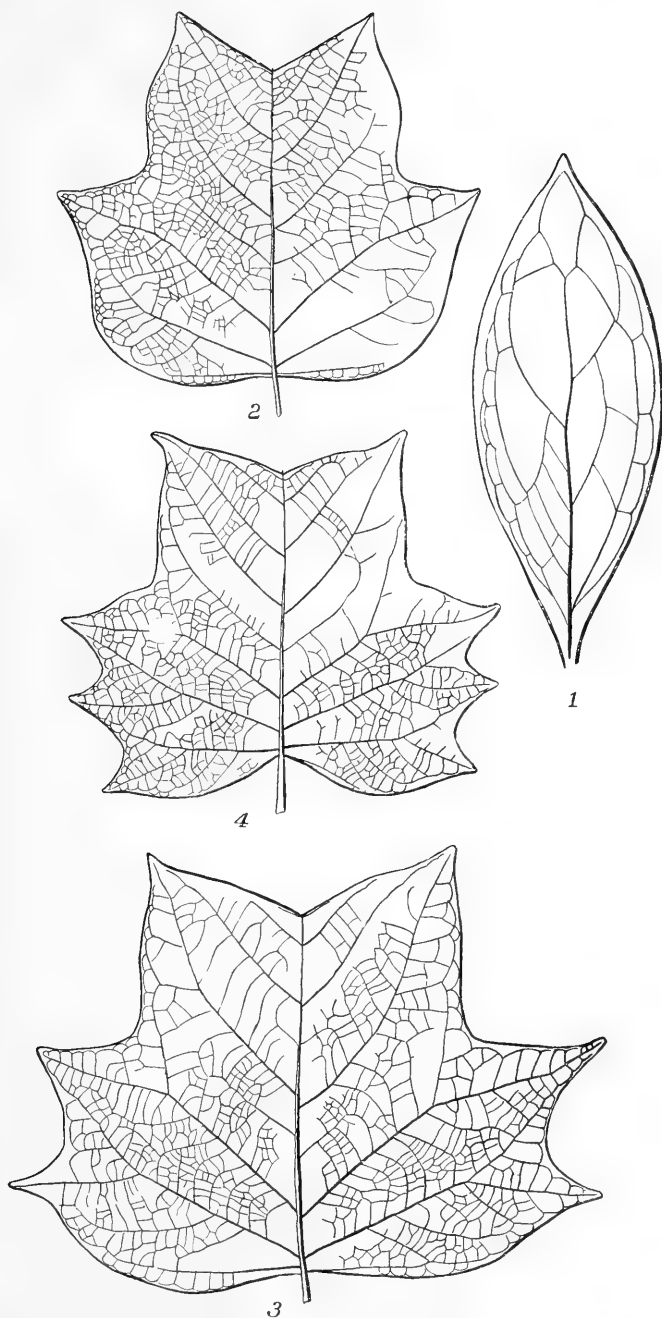
- FIG. 32. Leaf of a tree in the Botanical Garden, labeled var. *integrifolia*.
 33. Leaf of the same tree.
 34. Leaf of the same tree.
 35. Leaf, the oldest one of a branch from the same tree.
 36. Leaf, the oldest one of a branch from the same tree.
 37. Leaf, the oldest one of a branch from the same tree.

PLATE IX.

(Two-thirds natural size.)

- FIG. 38. Leaf, taken from an old tree. In the axil of this leaf had been developed a shoot, which carried the following leaves:
 39. The next youngest one.
 40. The third one after Fig. 41.
 41. The oldest one.

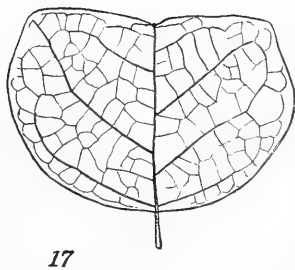
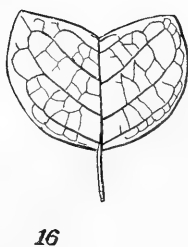
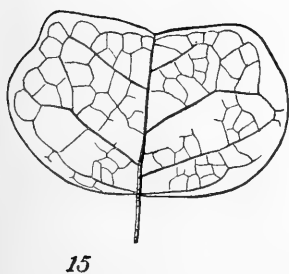
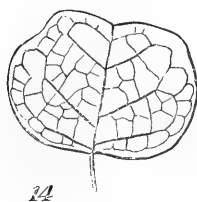
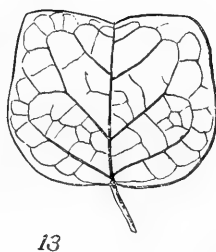
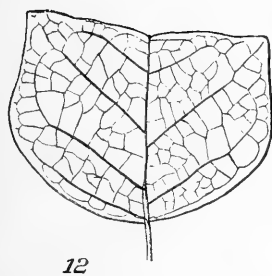
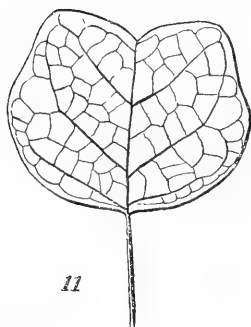
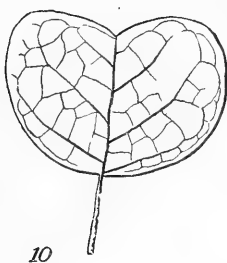
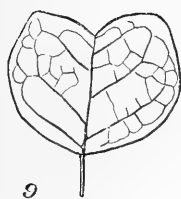
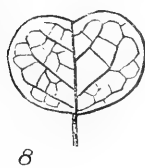
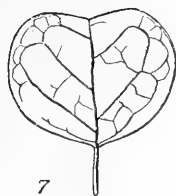
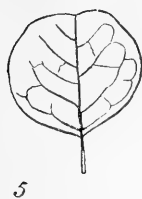




LEAVES OF LIRIODENDRON TULIPIFERA.

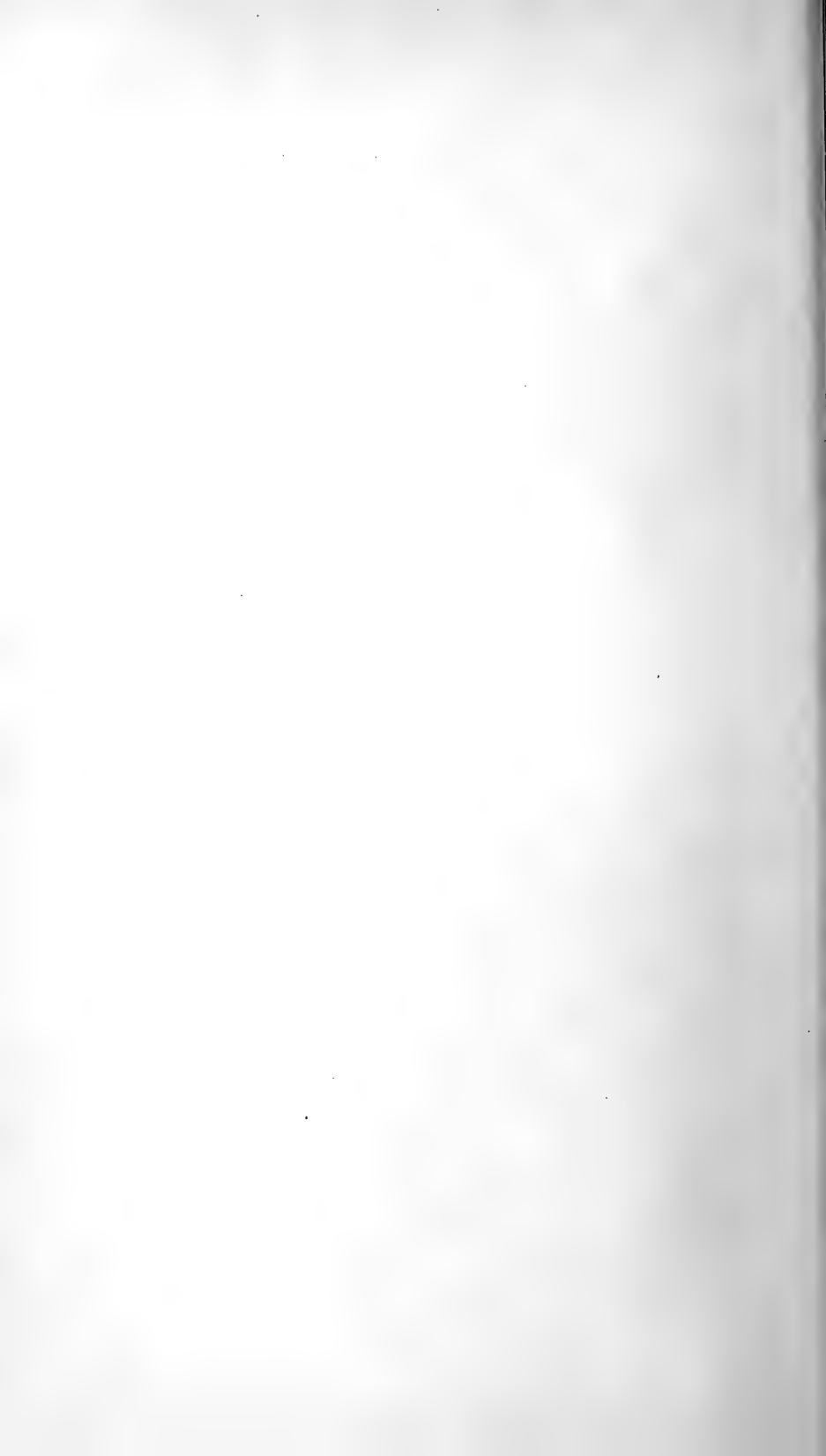
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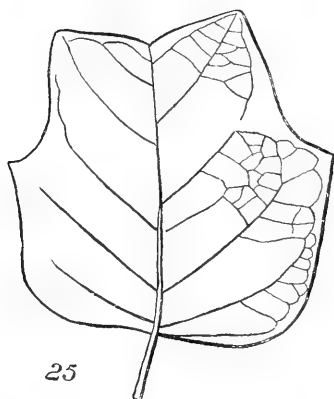
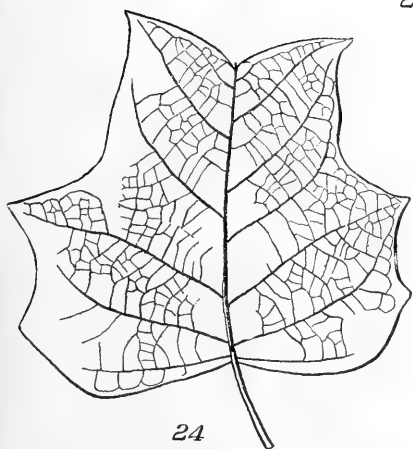
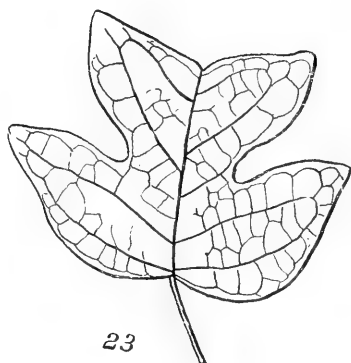
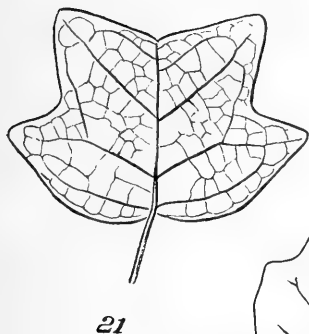
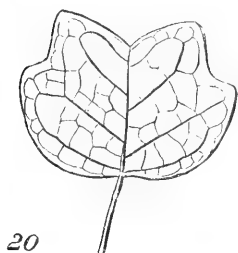
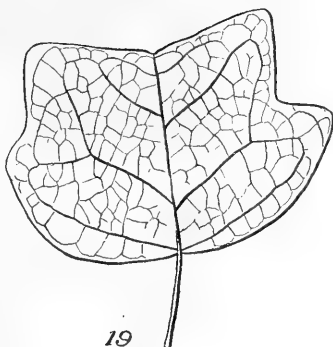
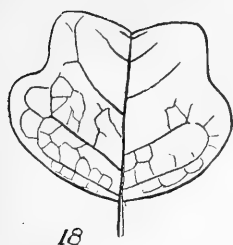




LEAVES OF LIRIODENDRON TULIPIFERA.

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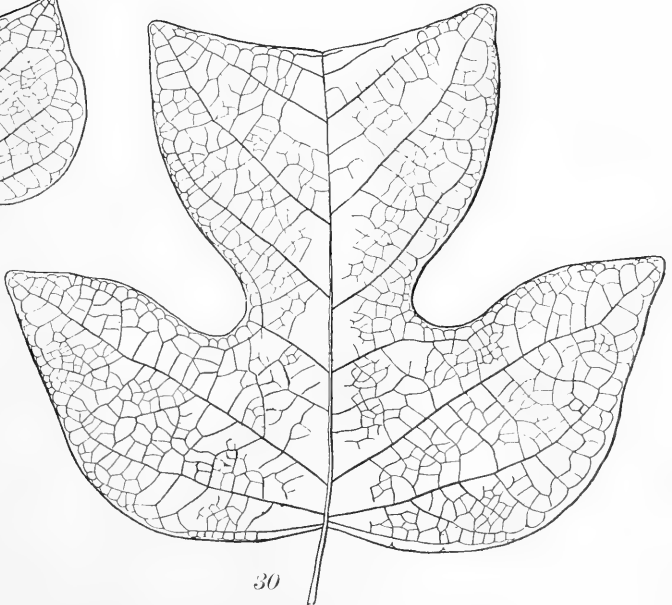
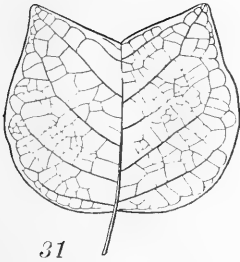
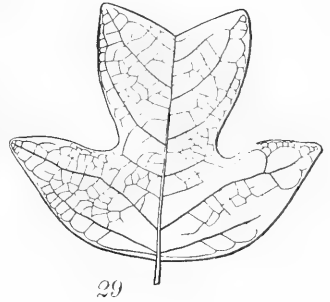
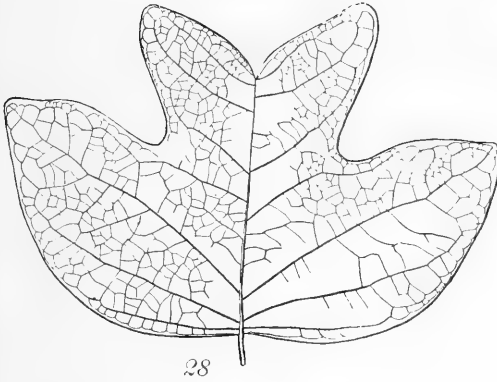
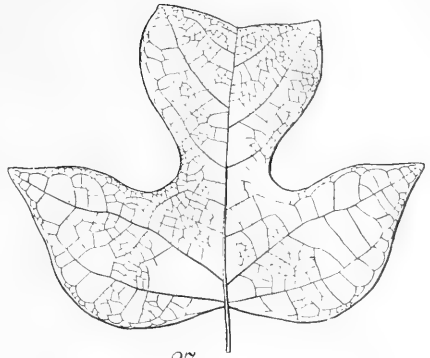
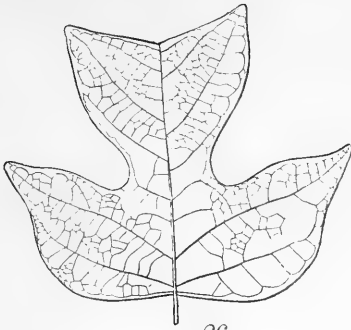




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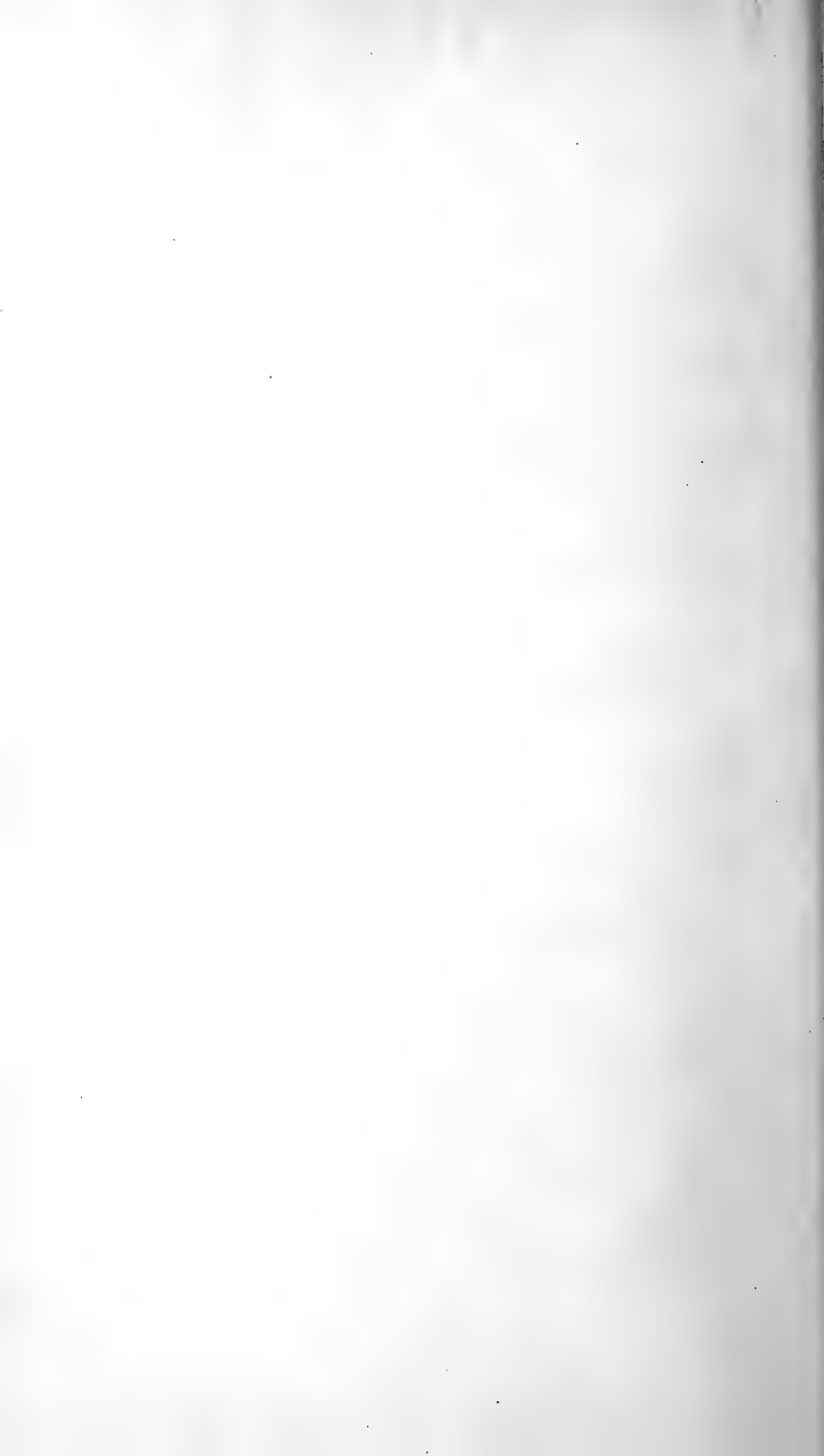
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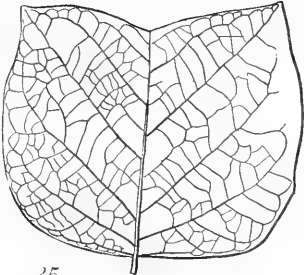
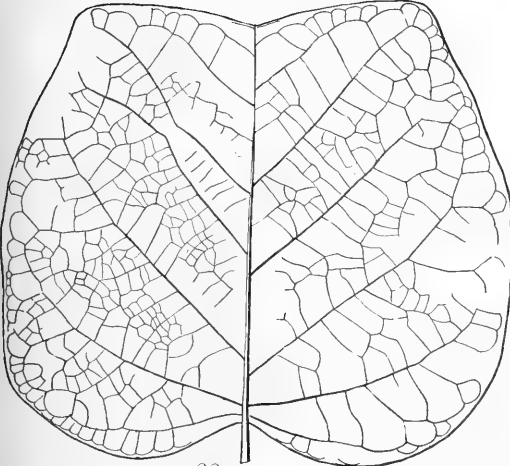
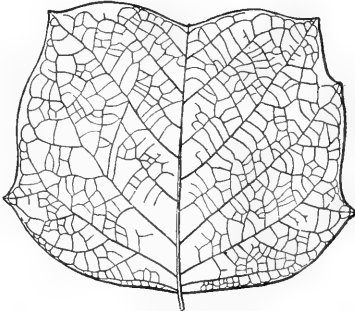
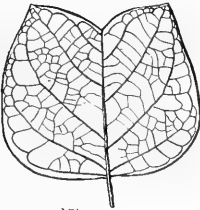
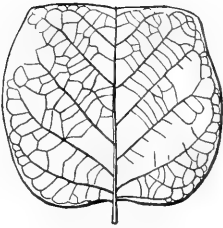
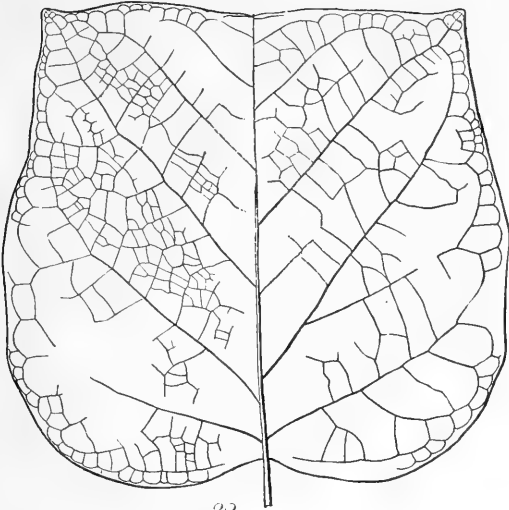




LEAVES OF *LIRIODENDRON TULIPIFERA*.

Drawn from nature by the author.

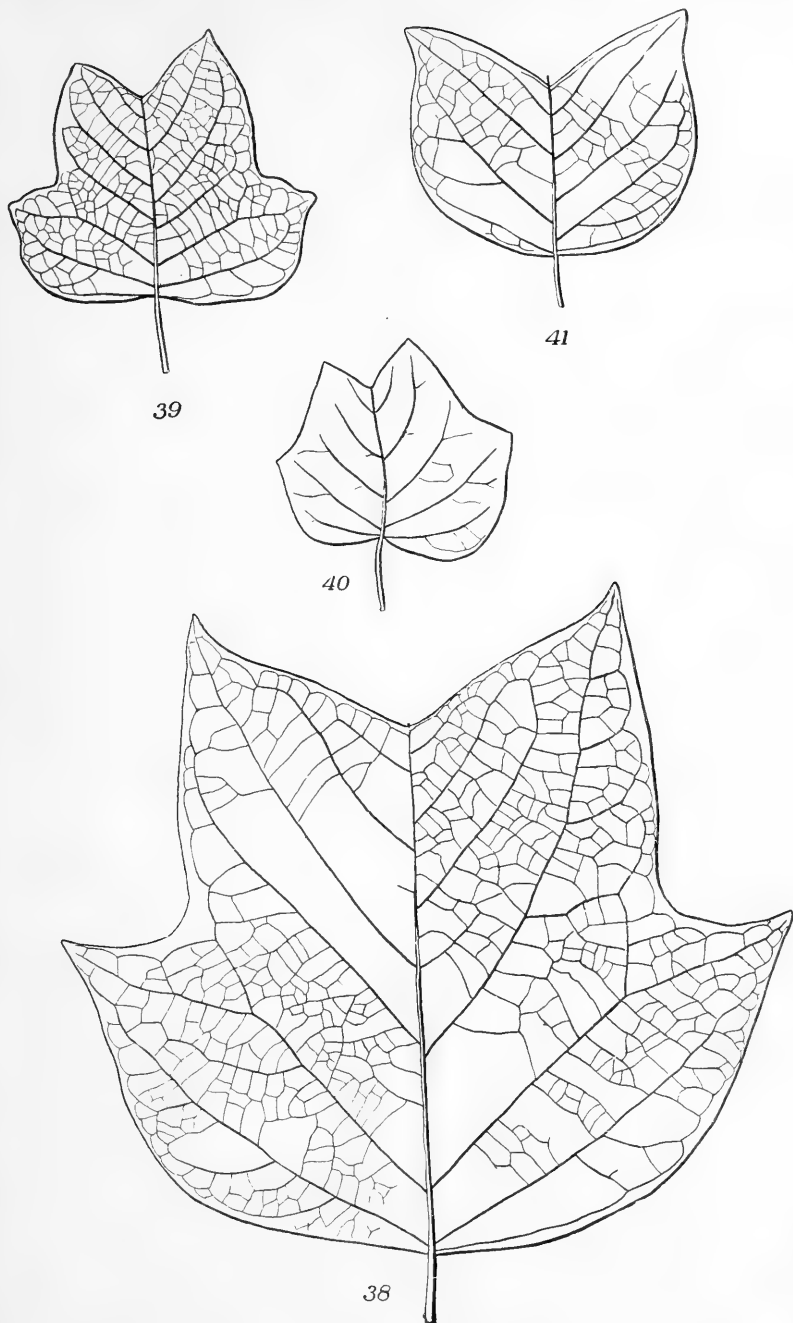




LEAVES OF LIRIODENDRON TULIPIFERA.

Drawn from nature by the author.





LEAVES OF LIRIODENDRON TULIPIFERA.

Drawn from nature by the author.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COMMISSION STEAMER ALBATROSS.

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No. XI.—NEW FISHES COLLECTED OFF THE COAST OF ALASKA AND THE ADJACENT REGION SOUTHWARD.

BY

TARLETON H. BEAN,

Ichthyologist, U. S. Fish Commission.

The fishes herewith described were obtained by the U. S. Fish Commission steamer *Albatross* during the summer of 1888, chiefly in August, in the waters of Alaska. Eight of the genera are among the common forms of the Atlantic. Four genera are apparently new to science.

Chalinura serrula, new species.

Three individuals were trawled August 29, 1888, at station 2859, north latitude $55^{\circ} 20'$, west longitude $136^{\circ} 20'$, in a depth of 1,569 fathoms, east of Prince of Wales Island. The type of the description is $12\frac{1}{2}$ inches long. The head is contained nearly $5\frac{1}{2}$ times in the total length. The eye is somewhat shorter than the snout and equals one-fifth length of head. A median serrated keel on the nose. The maxilla is two-fifths as long as the head and extends to below the end of the eye. Cheeks and opercles scaly. The barbel equals the snout in length and two-ninths of the head. The mandible is about one-half as long as the head. A row of five pores on its under surface and six pores on the edge of the suborbitals.

The branchiostegal membrane is narrowly free from the isthmus. The first gill-opening is restricted, as in *Macrurus*. The gill-rakers are small tubercles, eleven below the angle of the first arch and only one or two above the angle.

The pectoral equals the post-orbital part of the head in length. The ventral is about as long as the head. The longest dorsal spine is strongly serrated and nearly equals the head without the snout. The dorsals are separated by an interspace two-fifths as long as the head. B. 6; D. ii, 9-76 (?); scales, 7 or 8-130-17.

Body brown; head, abdomen, and inside of mouth purple; the purple areas less marked in the type specimen, which is $12\frac{1}{2}$ inches long.

Antimora microlepis, new species.

Two examples of this *Antimora* were taken August 31, 1888, at a depth of 876 fathoms in north latitude $51^{\circ} 23'$, west longitude $130^{\circ} 34'$, station 2860, off Cape St. James, Queen Charlotte Islands.

The one from which the illustration was made is $9\frac{5}{8}$ inches long to the base of the caudal, $10\frac{3}{8}$ inches in total. The eye is nearly equal to the snout in length, and is about one-fourth as long as the head, which is nearly one-fourth of the length, including the caudal. The depth is contained $5\frac{3}{8}$ times in the total without caudal, and equals two-thirds of the length of the head. The maxilla reaches nearly to below the end of the eye. The barbel is very slender and about one-half as long as the eye. Gill-rakers short, slender, $4 + 11$ on first arch.

The longest ray of the first dorsal is about one-half as long as the head. The anal is deeply emarginate; it begins under the twentieth ray of the second dorsal. The second ray of the ventral is six-sevenths as long as the head. D. 4 or 5, 51; A. 41.

The scales are very small and absent from the individuals before me. I count about nine impressions between the origin of the second dorsal and the lateral line, and about one hundred and thirty in the lateral line.

Color violaceous, deeper on the opercles and branchiostegal membrane and on the inside of the mouth.

Lycodes brevipes, new species.

Many specimens were trawled, July 31, 1888, at station 2848, in north latitude $55^{\circ} 10'$, west longitude $160^{\circ} 18'$, at a depth of 110 fathoms, between Unga and Nagai islands.

The eye is as long as the snout and one-quarter as long as the head, which is one-fifth of total length. The depth of body equals one-half length of head. The pectoral equals one-ninth of the total length. Ventrals minute, scarcely more than one-third length of eye. Head naked. Body covered with large scales except immediately behind pectoral. Dorsal and anal fins minutely scaled. Lateral line single, abruptly decurved and becoming obsolete over about the tenth anal ray. Dorsal origin nearly over middle of pectoral. Anal origin under the eighteenth ray of the dorsal. D. ca. 85; A. ca. 74; P. 21.

A narrow light band across the nape and from nine to eleven across the back extending downward about to median line and becoming obscure in adults. Dorsal and anal with a narrow dark margin.

Bothrocara, new genus *Lycodidae*.

This genus resembles *Maynea*, but the vomer and palate are toothless. Weak teeth in the jaws in narrow bands. The lower jaw is barely included. Pseudobranchiae present. Branchiostegals six. Gill-membranes narrowly attached to the isthmus. Large pores along the jaws

and extending back to the opercle. Scales about as in *Maynea*, not evident on anterior part of the body in my specimens. Ventrals wanting. No pyloric cæca. Intestine short. Vent at the end of the first third of length. Dorsal beginning over base of pectoral, continuous with anal, the rays high.

Bothrocara mollis, new species.

A single example, $5\frac{1}{2}$ inches long, was trawled August 31, 1888, at station 2860, off Cape St. James, Queen Charlotte Islands, in 876 fathoms.

The eye is as long as the snout and three-elevenths as long as the head. Length of the head is contained $5\frac{1}{4}$ times in the total length; the depth $9\frac{1}{8}$ times. The maxilla reaches nearly to below middle of eye. The longest dorsal ray equals the orbit in length. A space as long as the head will include the first eighteen dorsal rays. The anal begins under the fifteenth ray of the dorsal; the longest ray is half as long as the longest dorsal ray. The pectoral extends to beneath the twelfth ray of the dorsal.

Color, uniform light brown.

Maynea pusilla, new species.

The specimen described was obtained July 31, 1888, at station 2848, north latitude $55^{\circ} 10'$, west longitude $160^{\circ} 18'$, at a depth of 110 fathoms.

The length of the type is $6\frac{1}{2}$ inches. The depth is one-ninth of the total length; head one sixth of the same length. The eye equals $1\frac{1}{2}$ times the length of the snout and one-third the length of the head. The maxilla extends to below the front of the pupil. The low dorsal begins nearly over the axil of the pectoral. The pectoral is nearly two-thirds as long as the head. The vent is as far from the end of the head as the dorsal origin from the tip of the snout. D. ca 95; A. ca 81; P. 17.

Color, light brown. Dorsal and anal with a narrow dark margin.

Maynea brunnea, new species.

A single large example, 18 inches long, was obtained May 8, 1888, at station 2839, in north latitude $33^{\circ} 08'$, west longitude $118^{\circ} 40'$, off San Clemente Island, Southern California, at a depth of 414 fathoms.

D. 105; A. ca. 95; P. 17.

The eye equals width of interorbital space and is three-fourths length of snout and one-fifth head. The maxilla extends to below the middle of the pupil. Vomer and palate with villiform teeth in broad bands; intermaxilla and mandible with broad bands of teeth, the outer row not greatly enlarged.

The length of the head is contained $4\frac{2}{3}$ times in total length. The depth equals two-thirds length of head.

Dorsal and anal finely scaled almost to their margins. The upper lateral line begins in front of the upper axil of pectoral and extends to above the third anal ray.

The lower line begins under about the seventeenth ray of the dorsal and continues to the root of the caudal.

Color, brown; margins of dorsal and anal bluish.

Poroclinus, new genus, *Blenniidae*.

Body elongate, moderately compressed, covered with small scales; lateral line obsolete. Head moderately long; snout short; eyes large; interorbital space narrow. Mouth small, lower jaw slightly included; teeth on vomer and palate; narrow bands of teeth in jaws, the outer series enlarged. Gill openings slightly prolonged forward below, narrowly attached to the isthmus anteriorly. Dorsal composed of many sharp, flexible spines, diminished in length anteriorly. Caudal long, pointed. Anal with three spines and many rays. Pectorals large, the middle rays longest. Ventrals jugular, with one spine and three rays. Intestine short; pyloric cæca one or two; no air bladder.

Poroclinus rothrocki, new species.

A single individual, 7 inches long, was taken August 4, 1888, at station 2852, north latitude $55^{\circ} 15'$, west longitude $159^{\circ} 37'$, at a depth of 58 fathoms, between Nagai and Big Koniushi Islands.

B. VI; D. LXI; A. III, 44; V. I, 3.

The eye is a little longer than the snout, and about one-fourth length of head. The maxilla extends a little beyond front of eye. The length of the head is contained $6\frac{1}{2}$ times in total without caudal; the depth 11 times. The dorsal origin is distant from tip of snout a space equal to length of head. The pectoral is about two-thirds as long as the head, and is distant from the vent a space equal to its own length. The ventral equals two-thirds depth of body. The caudal is nearly as long as the head.

Ten narrow pale bands on the sides extending downward about to the median line. Caudal with a double crescent-shaped pale marking. General color, light yellowish brown. Dedicated to Dr. J. T. Rothrock, professor of botany, University of Pennsylvania.

Careproctus spectrum, new species.

Twenty-six specimens were obtained, July 31, 1888, at station 2848, in north latitude $55^{\circ} 10'$, west longitude $160^{\circ} 18'$, 110 fathoms, between Unga and Nagai Islands.

The example figured and diagnosed is $3\frac{9}{16}$ inches long. The ventral disk is small, two-thirds as long as the eye, which is one-third as long as the head. The head is one-fourth of the total length to base of caudal. The mouth is large, the maxilla extending to about below the

middle of the eye. The greatest depth is about equal to the length of the head. The pectoral reaches to above the anal origin. The dorsal begins over the axil of the pectoral. D. 52; A. 47. Color along back of some examples light brown, elsewhere uniformly pale.

Icelus scutigera, new species.

Three individuals were collected, August 9, 1888, at station 2853, in north latitude 56° , west longitude $154^{\circ} 20'$, depth 159 fathoms, off Trinity Islands.

D. IX, 19; A. 18; V. I, 3; lateral line 41.

The eye is twice as long as the snout and two-fifths as long as the head. The head is one-third as long as the total without caudal. The maxilla extends to below the middle of the eye, and is broadly expanded behind. The interorbital space is extremely narrow, less than one-fourth the length of the eye. The depth equals one-fifth of the total without caudal. The pectoral extends to above the sixth ray of the anal. The pre-operculum has a weak, simple spine hooked upward, and three weak ones pointing backward and downward. Teeth on vomer and palate.

The head has minute spiny scales most abundant on the upper half. All of the back above the lateral line is densely covered with small spiny scales. The lateral line is made up of raised tubes. There are a few rough scales under the lateral line in the second half of the body.

The branchiostegal membranes are broadly united and well freed from the isthmus. Slit behind fourth gill obsolete.

The spinous dorsal is very high, its longest spine two-thirds as long as the head. About four large, dark blotches across the back and several smaller ones between them.

The type is $3\frac{1}{2}$ inches long.

Icelus euryops, new species.

Three examples were obtained August 9, 1888, off Trinity Islands, at station 2853, with *Icelus scutigera*.

D. IX, 23; A. 18; V. I, 3; lateral line, 43.

The eye is about twice as long as the snout and two-fifths as long as the head. The head is one-third of the total length to base of caudal. The maxilla scarcely extends to below the middle of the eye. The interorbital space is about one-fourth length of eye. The depth of body is contained $5\frac{2}{3}$ times in total without caudal. The pectoral extends to above the second ray of anal. The preopercle is armed as in *Icelus scutigera*. Vomer and palate well toothed.

The head is scaled as in *I. scutigera*. The lateral line is composed of raised tubes. A single series of spiny scales on the back along the bases of the dorsals. Branchiostegal membranes broadly united, free from the isthmus. Slit behind last gill obsolete.

The spinous dorsal is low, its longest spine less than one-third length of head. Four dark bands across the back, the first over the end of the spinous dorsal, two on the soft dorsal and one at the base of the caudal. General color, light brown.

Dasycottus, new genus.

Related to *Cottunculus*, which it resembles in shape. Head large, with large bony tubercles and numerous filaments. Mouth wide; jaws equal, or lower jaw slightly projecting. Teeth minute, in villiform bands in the jaws. Vomerines in two patches, separated by an interspace. Palate toothless. Preopercle with two spines at its angle and two rudimentary ones on each edge of its lower limb. Gills $3\frac{1}{2}$, no slit behind the last. Gill-rakers short, tubercular, in moderate number. Gill-membranes free from the isthmus. Pseudobranchiæ present. Skin smooth, except on nape and along dorsal base, where it bears a few small, bony tubercles. Spinous dorsal well developed and separated from the soft dorsal by a deep notch. Pectorals moderately long, their rays procurent below. Ventrals with a spine and three rays. Caudal rounded.

Dasycottus setiger, new species.

Four individuals were trawled August 10, 1888, at station 2855, north latitude 57° , west longitude $153^{\circ} 18'$, at a depth of 69 fathoms, off Sitkalidak Island.

D. IX, 15; A. 13; V. I, 3; pores in lateral line, 11 or 12.

The depth equals about two-thirds length of head, which is nearly one-half of total length of base of caudal. The eye is nearly equal to the snout and is two-ninths of the length of head. The maxilla is expanded behind; its length equals that of the snout and eye combined; it extends to a little behind the middle of the eye.

The pectoral extends to above the anal origin. The ventral is one-half as long as postorbital part of head. The longest dorsal spine is about equal to the eye in length. Spinous dorsal with two dusky bands extending down on the sides; soft dorsal with two bands. A similar one at caudal base and three narrow bands on second half of caudal. Pectoral indistinctly banded. Head speckled with brown dots.

Malacocottus, new genus.

Shape similar to that of *Cottunculus*. Head large; body tapering rapidly to the slender tail; mouth terminal; jaws subequal. Minute villiform teeth in broad bands on maxilla and mandible; vomer and palate toothless. Preoperculum armed with short, stout, simple spines. Bones of the skull thin. Gills $3\frac{1}{2}$; no slit behind the last. Gill-openings wide, the membranes broadly attached to the isthmus. Gill-rakers tubercular, in moderate number. Spinous dorsal low, separated by a deep

notch from the soft dorsal. Pectorals procurent in front. Ventrals small. Caudal rounded. Vent distant from the anal origin. Head and body naked. Lateral line consisting of a series of large pores.

***Malacocottus zonurus*, new species.**

D. IX, 14; A. 11; V. I, 3; pores in lateral line, about 14.

The eye is about equal to the snout in length and is two-sevenths as long as the head. Interorbital space less than one-half length of eye. The maxilla extends to below the middle of the eye. The pectoral reaches to a vertical through the anal origin, or a little beyond. The ventral is scarcely as long as the eye. The depth equals length of head without snout. Spinous dorsal low; its base one-half as long as the head; its longest spine two-thirds as long as the eye. The beginning of the dorsal is immediately above the upper angle of the gill-opening. The least height of the tail is scarcely two-thirds length of eye. Four spines on the preopercle, the largest less than one-half as long as the eye and with a supplementary spine at its base.

A dark-brown saddle-shaped band over the end of the spinous dorsal and two on the soft dorsal. A brown band at the base of the tail and three on the caudal. Pectoral with several indistinct dark bands intermingled with pale areas. Tips of pectoral in its lower half exerted, milky white.

Seven examples were taken August 9, 1888, at station 2853, in north-latitude 56° , west longitude 154° , at a depth of 159 fathoms, off Trinity Islands. The type of the description and figure is $4\frac{3}{4}$ inches long.

***Hemitripteris marmoratus*, new species.**

Two small examples, each about $2\frac{3}{4}$ inches long, were trawled at a depth of 69 fathoms August 10, 1888, at station 2855, off Sitkalidak Island, north latitude 57° , west longitude $153^{\circ} 18'$.

D. XIV, 12; A. 13; V. I, 3; 44 tubes in lateral line.

The eye is about as long as the snout and one-quarter as long as the head, which is three-eighths of the total without caudal. The depth is three-elevenths of the total without caudal. The pectoral reaches to the vertical through the anal origin. The ventral is scarcely longer than the eye. The gill membrane is free from the isthmus. The maxilla reaches beyond the end of the eye. The first dorsal base is as long as the head without the snout; the first four species are less elevated and differentiated than is usual in the genus.

Sides dark gray, intermingled with whitish reticulations.

***Psychrolutes zebra*, new species.**

Many individuals were secured July 31, 1888, at station 2848, north latitude $55^{\circ} 10'$, west longitude $160^{\circ} 18'$, at a depth of 110 fathoms, between Unga and Nagai Islands.

The first dorsal contains nine weak spines and is entirely concealed under the skin. D. IX, 15; A. 12; V. I, 3. The eye is nearly one-fourth as long as the head and about equals snout and also width of interorbital space. The maxilla extends to below middle of eye. The head is three-eighths of total length to base of caudal. Depth equals head without snout. The pectoral reaches to above origin of anal. Ventral small, one-third length of head. Vent about midway between ventral and anal origin. The second dorsal begins nearly over the tip of the pectoral. Light chocolate-brown above, whitish below. Several narrow dark-brown bands across the first dorsal and a dark saddle over second dorsal, the markings extending down on sides. Pectoral with two, sometimes three, dark bands. A band at caudal base and several narrow bands on second half of caudal.

Sebastolobus alascanus, new species.

Several individuals were obtained August 9, 1888, at station 2853, off Trinity Islands, north latitude 56° , west longitude 154° , at a depth of 159 fathoms. The largest one is $4\frac{7}{10}$ inches long.

D. XV, I, 9; A. III, 5; V. I, 5; P. 20; lateral line 32 or 33.

The lower five rays of the pectoral are lengthened and project beyond the membrane. The eye is twice as long as the snout and two-fifths the length of the head. The maxilla extends nearly to below end of eye. The length of the head is contained $2\frac{2}{3}$ times in total length without caudal. The depth is one-quarter of total without caudal. The first dorsal spine is one-half as long as the second, one-quarter as long as the fourth, which is about one-third of length of head. The first anal spine is two-fifths of the second, which is one-fifth of total without caudal.

A dark blotch on membranes between first and third dorsal spines, and a large one from sixth to eleventh spine.

Chauliodus macouni, new species.

An individual $3\frac{2}{3}$ inches long was trawled August 31, 1888, at station 2860, north latitude $51^{\circ} 23'$, west longitude $130^{\circ} 34'$, at a depth of 876 fathoms off Cape St. James, Queen Charlotte Islands.

D. VI; A. 11; V. 7; P. 13; scales 56.

The eye is equal to the snout in length, and two-ninths of length of head. The longest mandibular tooth is nearly one-half length of head. The head equals about one-sixth of total length without caudal.

The dorsal begins over the fifth row of scales; its first ray equals two-ninths of total without caudal; its base equals one-third length of head. The adipose dorsal-base equals two-thirds anal base. The ventral is under the seventeenth row of scales; its length one-fifth of total without caudal. The anal base equals one-half length of head; its longest ray nearly one-fourth length of head.

Dedicated to Prof. John C. Macoun, of the Geological Survey of Canada.

Labichthys gilli, new species.

An example $18\frac{1}{5}$ inches long was taken, August 29, 1888, at station 2859, east of Prince of Wales Island, north latitude $55^{\circ} 20'$, west longitude $136^{\circ} 20'$, depth 1569 fathoms.

The eye is one-half as long as the post-orbital part of head, and about two-thirds length of pectoral. The post-orbital part of the head is one-fourth length of upper jaw, and three-elevenths of lower jaw from angle of mouth. The dorsal begins nearly over the end of the pectoral. The vent is distant from the head a space equal to four times post-orbital part of head. The depth of body equals length of head without the snout, and about one-thirty-ninth of total. Dorsal rays very short. The longest anal ray equals one-fifth length of head. The lateral line is made up of a single series of large pores. This species resembles *L. carinatus*, but in that species the dorsal begins over the pectoral origin and the vent is close behind the pectorals. Color uniform black. The species is named for Dr. Theo. Gill, the discoverer of the genus *Labichthys*.

FURTHER NOTES ON THE GENUS XIPHOCOLAPTES OF LESSON.

BY

ROBERT RIDGWAY,
Curator of the Department of Birds.

1. *Xiphocolaptes procerus* CAB.

Since my "Review" of this genus was printed (see these Proceedings, vol. XII, pp. 1-20), I have received through kindness of the authorities of the Boston Society of Natural History a mounted specimen belonging to the Lafresnaye collection (No. 2219) labeled "*Xiphocolaptes procerus* Caban., S. A." While this specimen certainly can not be identified with any of the species which I was able to characterize in my paper, I am unable to determine from Cabanis's very brief description whether it is really that species or not. From the description of *X. procerus* it differs (1) in the wings and tail being *not* "lighter cinnamon brown than in *X. promeropirhynchus*," and (2) streaks on the under parts *not* more indistinct than in that species. It agrees with the description, however, in having the bill much larger than in *X. promeropirhynchus* as well as much paler in color (dull ivory-whitish instead of blackish), though other measurements are about the same. It may be described in detail as follows:

Most like *X. promeropirhynchus*, but bill very much deeper and dull ivory-whitish instead of blackish; general coloration much paler, with streaks on pileum and under parts dull whitish instead of strong buff; chin and throat white very faintly tinged with buff instead of deep buff, and belly but very faintly spotted. Pileum and hind-neck dull light sepia, streaked with dull buffy whitish; back, scapulars, and wing-coverts dull raw-umber brown; lower back, rump, and upper tail-coverts bright russet, tinged with cinnamon-rufous; remiges and inner webs of greater and primary coverts chestnut-rufous, the terminal portion of inner webs of primaries (except innermost quills) dull brownish and edges of outer webs, toward base, washed with the color of the back; tail deep chestnut, lighter on outer feathers. Chin and throat plain buffy white; rest of under parts light raw-umber brown, each feather with a broad mesial streak (averaging about .08 of an inch wide on chest and breast) of buffy white, these streaks on the belly margined by very indistinct specks of a deeper hue than the ground-color; under

tail coverts marked like the belly, but less distinctly, and the general color tinged with tawny. Bill dull ivory-whitish, becoming grayish at base. Wing 5.60, tail 5.00, culmen 2.08 (exposed portion 1.85), depth of bill at angle of gonys .45, tarsus 1.20, middle toe 1.05.

A mounted specimen in the American Museum of Natural History (Elliot collection, No. 5267, "Bogota"), labeled "*Xiphocolaptes promeropirhynchus*," is somewhat similar to the above, but has the bill less deep and more extensively grayish basally, the ground-color of the pileum darker, the belly quite as distinctly spotted as in some specimens of *X. promeropirhynchus*, and only the upper portion of the throat plain whitish, the lower throat being broadly streaked with brown, like the chest. It is in some respects intermediate between *X. promeropirhynchus* and the above specimen, whatever it may be, but can not be referred to either; neither am I able to refer it to anything else. Its measurements are as follows: Wing 5.25, tail 5.10, culmen 2.05 (exposed portion 1.82), depth of bill at angle of gonys, .40, tarsus 1.22, middle toe 1.02.

2. *Xiphocolaptes albicollis* (LIGHT.).

Two mounted specimens in the American Museum of Natural History are very doubtfully referable to this species. One of them (No. 5265) belongs to the Maximilian collection, and is labeled "*Dendrocolaptes guttatus* Licht. Fem. Brasilia. M. R. Mas." Compared with lighter colored examples of *X. albicollis*, this specimen agrees with the latter quite closely, except in the ground-color of the pileum, which is distinctly deep brown instead of blackish, and in the color of the bill, which is paler, or horn color instead of blackish or dusky. Its measurements are as follows: Wing, 5.10; tail, 5.00; culmen, 1.95; depth of bill at angle of culmen, .37.

The other specimen (No. 5266, ♂, Brazil), belonging to the Verreaux collection is very pale, the ground-color of the breast being a pale broccoli brown, deepening into isabella color on the flanks; the ground color of the pileum is dusky brown, and the chin and throat are pure white. Wing, 5.00; tail, 5.20; culmen, 1.95; depth of bill at angle of gonys, .34.

It may be that the pale coloration of these specimens is partly due to their long exposure to light in museum cases.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COM-
MISSION STEAMER ALBATROSS.

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NO. XII.—A PRELIMINARY REPORT ON THE FISHES COLLECTED BY THE
STEAMER ALBATROSS ON THE PACIFIC COAST OF NORTH AMERICA
DURING THE YEAR 1889, WITH DESCRIPTIONS OF TWELVE NEW GENERA
AND NINETY-TWO NEW SPECIES.

BY

CHARLES H. GILBERT,

Professor of Zoology, University of Indiana.

The investigations of the *Albatross* during the year 1889 extended over the following regions:

- (1). The coast of California south of Point Conception, together with the outlying islands (stations 2891 to 2982).
- (2). The Revillagigedo Islands, Clarion, Socorro, and San Benedicto (stations 2991 to 2995).
- (3). The Gulf of California and the western coast of Lower California (stations 2996 to 3045).
- (4). The coasts of Oregon and Washington (stations 3046 to 3076).

The shore-fishes of California, Oregon, and Washington were already well known, and the new discoveries from these regions were almost wholly from greater depths than 50 (from 50 to 1000) fathoms.

From the Revillagigedos not more than a dozen species in all had been previously recorded. Of the sixty obtained from shallow water during our short stay not more than half are yet known from the neighboring mainland, the other half, including, together with new forms, a number of strays from the islands of the Western Pacific and from the Galapagos.

The collections from the Gulf of California were obtained mainly along the shores and in the shallower waters of its northern portion; the deeper waters of the Gulf having a bottom of blue mud singularly barren of life.

The present paper deals only with the new forms obtained on the cruise, and will be followed by a more extended report.

The following genera and species are here described as new:

1. *Myetophum nannochir*.
2. *Myetophum mexicanum*.
3. *Myetophum protoculus*.
4. *Bathytroctes stomias*.
5. *Idiacanthus antrostomus*.
6. *Bathylagus pacificus*.
7. *Synodus lacertinus*.
8. *Etrumeus acuminatus*.
9. *Argentina sialis*.
Leuroglossus gen. nov. (Argentinidae).
10. *Leuroglossus stilbins*.
11. *Neoconger verniformis*.
12. *Ophichthys nothochir*.
13. *Exocoetus xenopterus*.
14. *Melamphaës lugubris*.
15. *Melamphaës cristicipes*.
16. *Serranus æquidens*.
17. *Pronotogrammus eos*.
18. *Micropogon megalops*.
19. *Cynoscion macdonaldi*.
20. *Pseudojulis adustus*.
21. *Pseudojulis melanotis*.
22. *Pseudojulis inornatus*.
23. *Halichæres sellifer*.
24. *Thalassoma virens*.
25. *Thalassoma grammaticum*.
26. *Thalassoma socorroense*.
Calotomus gen. nov. (Labridæ).
27. *Calotomus xenodon*.
28. *Microspathodon cinereus*.
29. *Holacanthus clarionensis*.
30. *Gobius zebra*.
31. *Gobius dalli*.
32. *Microgobius cyclolepis*.
33. *Sebastichthys* [goodei Eigenmann].
34. *Sebastichthys alutus*.
35. *Sebastichthys rupestris*.
36. *Sebastichthys zacentrus*.
37. *Sebastichthys saxicola*.
38. *Sebastichthys diploproa*.
39. *Sebastichthys aurora*.
40. *Sebastichthys introniger*.
41. *Sebastichthys sinensis*.
42. *Scorpena sierra*.
43. *Icelinus cavifrons*.
44. *Icelinus filamentosus*.
45. *Icelinus tenuis*.
46. *Icelinus fimbriatus*.
47. *Icelinus oculatus*.
Radulinus gen. nov. (Cottidæ).
48. *Radulinus asprellus*.
Bathyagonus gen. nov. (Agonidæ).
49. *Bathyagonus nigripinnis*.
Xenochirus gen. nov. (Agonidæ).
50. *Xenochirus triacanthus*.
51. *Xenochirus pentacanthus*.
52. *Xenochirus latifrons*.
53. *Paraliparis rosaceus*.
54. *Gobiesox pinniger*.
55. *Gobiesox funebris*.
56. *Gobiesox humeralis*.
57. *Gobiesox eigenmanni*.
58. *Gobiesox papillifer*.
59. *Bathymaster hypoplectus*.
Gillellus gen. nov. (Leptoscopidæ).
60. *Gillellus semicinctus*.
61. *Gillellus arenicolus*.
62. *Dactyloscopus lunaticus*.
63. *Labrosomus cremnobates*.
Cryptotrema gen. nov. (Blenniidæ).
64. *Cryptotrema corallinum*.
Plectobanchus gen. nov. (Blenniidæ).
65. *Plectobanchus evides*.
Lucioblennius gen. nov. (Blenniidæ).
66. *Lucioblennius alepidotus*.
67. *Lycodes porifer*.
68. *Lycodopsis croatalinus*.
69. *Lycodopsis crassilabris*.
Aprodon gen. nov. (Lycodidæ).
70. *Aprodon cortezianus*.
Lycodapus gen. nov. (Lycodidæ).
71. *Lycodapus fierasfer*.
72. *Leptophidium pardale*.
73. *Leptophidium microlepis*.
74. *Leptophidium stigmatistium*.
75. *Leptophidium emmelas*.
76. *Ophidium galeoides*.
77. *Catetyx rubrirostris*.
78. *Neobythites stelliferoides*.
79. *Physiculus rastrelliger*.
80. *Physiculus nematopus*.
81. *Macrurus scaphopsis*.
82. *Macrurus stelgidolepis*.
83. *Macrurus liolepis*.
84. *Platophrys tæniopterus*.
85. *Citharichthys xanthostigma*.
86. *Citharichthys fragilis*.
87. *Ancylosetta dendritica*.
88. *Hippoglossina bollmani*.
Lioglossina gen. nov. (Pleuronectidæ).
89. *Lioglossina tetrophthalmus*.
90. *Cynicoglossus bathybius*.
91. *Halientæa spongiosa*.
92. *Melichthys bispinosus*.

1. *Myctophum nannochir* sp. nov.

Closely resembling *M. engraulis* in appearance, differing in the posterior insertion of both rayed and adipose dorsal, and in the color.

Head $3\frac{1}{2}$ to $3\frac{3}{4}$ in length; depth 5.

Eye large, longer than snout, 4 in head in young (3 inches long), $4\frac{1}{2}$ in head in adults (5 inches long). Interorbital space wide, $3\frac{2}{3}$ in head, the ethmoidal ridge prominent, continuous backwards with the low ridge on middle of occiput. Supraocular ridge prominent, expanded.

Lower jaw included, the tip of mandible slightly projecting. Mouth rather large, the maxillary not reaching the anterior margin of preopercle, $1\frac{1}{2}$ in head. Maxillary slightly expanded at tip, its width less than half diameter of pupil. Gill-rakers long and slender, 5 by 18 on outer arch.

Origin of dorsal nearer posterior margin of orbit than adipose fin, its base a trifle less than half head, the vent under its middle. Adipose fin wholly behind base of anal, which is contained $1\frac{2}{3}$ in length of head. Pectorals very short and narrow, with about nine rays, not reaching base of ventrals and less than one-third head. Ventrals inserted well in advance of dorsal, their distance from tip of snout $2\frac{1}{3}$ in length of body.

D. 12 or 13; A. 15 or 16. Lat. 1. 35 or 36.

Scales large, entire.

Color: Grayish or blackish, the opercle jet-black. Caudal black at base, the fins otherwise more or less dusky (translucent in the young); a light area usually present on middle of ventrals. Commencing on branchiostegal membranes, the phosphorescent spots are arranged in two series near median ventral line, extending back to base of caudal. Four pairs of spots in advance of ventral, seven pairs between ventrals and anal, the series diverging posteriorly and terminating in a spot above front of anal and immediately below lateral line. The series begins again at front of anal, along base of which are six or seven pairs of spots; seven pairs along tail and four at base of lower caudal lobe. A spot at angle of preopercle, three just behind shoulder girdle, and four on sides midway between lateral line and ventral outline.

No glandular spot in front of eye; a large one occupying back of tail and one below.

Very abundant along the entire Pacific coast of the United States. Specimens were secured at Stations 2925, 2948, 3071, and 3072, in from 266 to 685 fathoms.

2. *Myctophum mexicanum* sp. nov.

Body slender, the eye rather small, the snout comparatively acute.

Depth, $5\frac{3}{4}$ in length; head, $3\frac{1}{2}$. Eye longer than snout, 4 to $4\frac{1}{2}$ in head; snout, $6\frac{1}{2}$; interorbital width, 5.

Ethmoidal ridge low, ending above middle of eye; a shallow depression behind it on occiput, the latter without ridge and not con-

spicuously arched. Upper outline of snout gently rounded, not projecting beyond mouth, the jaws equal. Maxillary slightly dilated at tip, not reaching preopercle, $1\frac{2}{5}$ in head; gill-rakers, 5 + 10.

Front of dorsal midway between tip of snout and base of caudal, the vent under middle of dorsal base. Adipose dorsal inserted over last anal ray. Ventrals reaching vent, inserted well in advance of dorsal, equidistant between front of orbit and last anal ray. Pectorals minute, of three or four rays only, their length scarcely half diameter of orbit (possibly somewhat mutilated).

D. 12; A. 14. Lat. l. 30 to 33.

No phosphorescent spot in front of eye. A small glandular streak on back of tail and below. Spots arranged as follows: Three pairs on branchiostegal membranes, one on preopercle above its angle; four pairs behind shoulder girdle, the upper one on lateral line, the lower pair on breast; three other pairs on breast and another higher up on sides; six pairs between ventrals and front of anal, three of these near median line, the other three higher up on sides; six pairs along anal fin, the series here diverging posteriorly, the last pair on lateral line; six pairs of spots along under side of tail, and three along base of lower caudal lobe. This species has four pairs of spots located on the lateral line and separated by about equal distances. The general color is brownish, the opercles steely or blue-black, the base of caudal black, and an intense black bar on gular membrane immediately behind symphysis.

Six specimens, the largest 2 inches long, from Stations 3008 and 3009, in from 306 to 857 fathoms.

3. *Myctophum protoculus* sp. nov.

D. 12; A. 13 or 14. Lat. l. 35 L. $2\frac{3}{4}$ in.

Eye very large, placed anteriorly and superiorly, the snout very bluntly rounded, projecting but little beyond the eye; length of snout about one-third diameter of orbit. Body rather deep, its depth 4 in length; head $3\frac{1}{2}$. Depth of head $1\frac{1}{3}$ in its length. Occipital region very convexly arched, without median crest. Interorbital space flatish, divided anteriorly by the very high ethmoidal ridge, posteriorly by the forward continuation of the occipital arch.

Lower jaw included, the maxillary not expanded behind, $1\frac{1}{2}$ in head. Rami of lower jaw expanded, meeting along median line to form a raised crest. Gill rakers long and slender, thirteen on horizontal limb of anterior arch.

Front of dorsal nearer tip of snout than base of caudal by a distance varying from a diameter of orbit to one-half that length. Length of dorsal base $1\frac{4}{5}$ in head. Front of anal midway between base of median caudal rays and base of pectorals. Ventrals inserted slightly in advance of front of dorsal, the fin reaching front of anal. Pectorals very

slender, with about ten rays, not reaching beyond base of ventrals, one-half head. Adipose dorsal slightly behind last anal ray.

Scales all lost.

Color: Blackish, iris bright silvery. A conspicuous silvery (phosphorescent) spot in front of eye above nostril. A glandular white spot above each pectoral. No glandular masses on back or under side of caudal peduncle. Three pairs of spots on gill membranes, visible through the mandible; a series of four on each side following curve of shoulder girdle; two pairs on breast; a pair on base of ventrals more widely separated than those preceding; four pairs on belly, the lines then diverging and extending nearly to lateral line, each containing three spots; a pair on sides above base of ventrals, and one above middle of abdomen; five pairs along base of anal, the series slightly diverging posteriorly and terminating in a sixth pair higher up on sides; five or six pairs along under side of tail and three or four along base of lower caudal lobe.

Three specimens from station 3072, in 584 fathoms.

4. *Bathytroctes stomias* sp. nov.

Differing from all species described in its very large mouth, the front of eye being over the middle of upper jaw.

Body slender, the greatest depth at vertical of base of pectorals $5\frac{2}{3}$ in length. Depth of caudal peduncle one-half greatest depth; head $3\frac{7}{8}$ in length.

Premaxillaries expanded anteriorly to form a triangular projection resembling that of *Labidesthes*, and overlapping the lower jaw. Mouth very large, the maxillary extending far behind the eye, its length nearly equalling the depth of body, $1\frac{3}{4}$ in head. Eye small, $6\frac{1}{4}$ in head; snout $3\frac{2}{5}$; interorbital width, $5\frac{1}{4}$.

Teeth in jaws small, close-set, incurved, depressible, none of them enlarged; those in mandible in a wide band, in premaxillaries or maxillaries in a narrow band or a single irregular series. Teeth on vomer and palatines larger than those in jaws, in a single series. The palatines form a conspicuous projecting ridge on each side of roof of mouth.

Top of head with a conspicuous deep lengthwise groove extending from nape forward to snout and half as wide as interorbital space. A large mucous canal, which runs along its rim posteriorly, opens above orbit. Gill rakers long and slender, the longest over two-thirds diameter of orbit, $5 + 13$ in number.

Dorsal beginning in advance of vent, the distance of its origin from base of caudal equalling one-third length. The length of its base equals its distance from rudimentary caudal rays, or about one-half head. Origin of anal slightly behind middle of dorsal, the length of its base $2\frac{3}{5}$ in head. Ventrals posteriorly inserted, their base twice as far distant from pectorals as from front of anal. Caudal forked, with many rudi-

mentary rays above and below. The paired fins are so mutilated that nothing can be learned as to their shape or length.

Scales large, nine in a series from ventrals forward to lateral line. Lat. 1. 57; D. III, 17; A. II, 14; V. 8; P. 9.

Color: Dark brownish, the fins blackish, head, mouth, gill-cavity, and peritoneum jet-black.

One specimen, 13 inches long, from station 3074, in 877 fathoms.

5. *Idiacanthus antrostomus* sp. nov.

Abdomen much dilated, abruptly constricted immediately behind the ventral fins, and much narrowed also anteriorly, the depth again increasing to occiput. Greatest depth immediately in front of ventrals, one-sixteenth of the total length; head one-twelfth. Maxillary reaching edge of gill cover.

Teeth in a single series in each jaw, readily depressible, varying greatly in length. The teeth in the upper jaw are evidently arranged in groups of four or five, the anterior member of each group being very short, the others rapidly increasing backwards, the posterior tooth very long. In the mandible the lateral teeth are inserted at the extreme outer edge of the jaw, but the anterior teeth are inserted farther inward; thus the last of the anterior teeth are distinctly within the first of those on sides of jaw. A single small tooth on each side of vomer, and two or three posteriorly on palatines. Three pairs of teeth directed backwards from near tip of tongue.

Eye over first third of length of maxillary. Lower jaw much longer than the upper. Barbel one-third longer than the head, expanded near its tip, and again narrowed as in *I. ferox*.

Dorsal beginning well in advance of ventrals, its distance from tip of snout $3\frac{1}{2}$ in total length. The anterior rays are distant, the membrane from one ray reaching only to basal portion of the succeeding ray. Each ray starts behind a pair of short spinous projections which diverge backwards, the fin when depressed lying in the groove formed by these diverging pairs of spines. Caudal forked, the rudimentary rays extending well forwards on caudal peduncle, nearly meeting posterior rays of dorsal and anal. Vent immediately in front of anal fin, far behind the dilated abdomen, its distance from end of caudal $3\frac{1}{2}$ in total length. The anal is similar to dorsal. Ventrals about three-fourths length of maxillary, very slender, composed apparently of five or six slender rays. They are inserted much nearer front of anal than head, the former distance about half their distance from tip of snout.

D. 57; A. ca. 35.

Color: Black, the mandible lighter, the base and terminal portion of barbel and the caudal translucent. No evident phosphorescent spot on cheek. Four series of minute phosphorescent dots on abdomen, the lateral series extending but a short distance behind ventrals, the median series uniting to form a single row behind these fins.

A single specimen, $4\frac{1}{2}$ inches long, from station 2980, in 603 fathoms.

6. *Bathylagus pacificus* sp. nov.

This species differs from *B. antarcticus* and *B. atlanticus* in the narrow channeled interorbital space and the slenderer body.

Anterior profile not decurved, the premaxillaries anteriorly on level of middle of eye.

Depth $1\frac{1}{3}$ in head and about $6\frac{2}{3}$ in the length; head 4. Eye $2\frac{1}{4}$ in head; snout short, less than half eye; interorbital space narrow, deeply grooved, one-third diameter of orbit.

Lower jaw with a series of small teeth, the very weak premaxillaries toothless; a strong series of teeth on vomer and palatines.

Front of dorsal midway between adipose dorsal and front of snout. Ventrals inserted under posterior end of dorsal. Anal inserted far back, the vent immediately in front, the length of tail equaling that of head.

D. 8 or 9; A. 16; P. 9. Lat. l. 40.

Scales lost; about forty in lateral line, judging from impressions on the skin.

Color: Head, lining of mouth and gill cavity, and peritoneum, jet black. Fins blackish. In its present condition the general color of the sides is black; margins of scale-pouches black. The fish was probably wholly black in life.

Two specimens, taken off the coast of Washington, at stations 3071 and 3074, in 685 and 877 fathoms.

7. *Synodus lacertinus* sp. nov.

With short snout, small scales, short pectorals and anal, and low dorsal.

Head, $3\frac{4}{5}$ in length; depth, $5\frac{3}{5}$. D. 11; A. 8. Lat. l. 68.

Snout, $4\frac{1}{3}$ in head, $2\frac{3}{4}$ in maxillary, its length slightly less than its width at base. Eye over middle of premaxillary, which is $1\frac{3}{4}$ in head; eye, 6. Interorbital width half snout. Occiput with well-developed rugosities.

Scales on cheeks crowded, in six rows. Four series between adipose fin and lateral line.

Front of dorsal nearer tip of snout than adipose fin by a distance equaling diameter of pupil. The fin is low, the tips of anterior rays barely reaching base of posterior ray in reflexed fin. Base of dorsal $1\frac{7}{9}$ in head. Upper outline of dorsal convex. Anal very small, its base one-third length of head. Pectorals very short, bluntly rounded, the longest ray $2\frac{1}{2}$ in head, not reaching beyond vertical from base of ventrals. Ventrals reaching half way to front anal, $1\frac{1}{7}$ in head.

Color: Black, with five broad dark bars reaching to lateral line or below. The middle of each interspace with a fainter bar confined to back. Mandible below with alternating brown and silvery cross-bars. A black spot at lower angle of cheeks, with a small silvery blotch be-

low it. Inside of mouth and gill cavity not dark. Dorsal and caudal with traces of faint dark bars.

One specimen, $6\frac{1}{4}$ inches long, from Acapulco, Mexico.

8. *Etrumeus acuminatus* sp. nov.

Differing from *E. micropus* and *E. sadina* in the much smaller eye, the longer, more acuminate snout, and the posterior dorsal.

Body slender, the belly rounded, the depth 6 in length; head, $3\frac{1}{2}$. Eye small, $1\frac{2}{5}$ in snout, $4\frac{1}{5}$ in head. Maxillary scarcely reaching vertical from front of orbit, about as long as snout, 3 in head. Teeth evident in both jaws and along sides of maxillary and on vomer and palatines.

D. 16 or 17; A. 10 or 11.

Front of dorsal nearer base of caudal than tip of snout (nearer snout in other species). Ventrals inserted behind the dorsal, slightly nearer base of caudal than base of pectorals.

Scales small, in about sixty transverse rows, judging from the impressions on the skin.

Color: Translucent, a faint trace only of a narrow lateral silvery streak, above which is a line composed of coarse black specks. Sides of head silvery, with little or no black specking. Mandible and occiput dusky. More or less black specking along base of vertical fins, and a narrow black behind the anal.

Six specimens of this species were secured in the Gulf of California, at station 3012 (22 fathoms), and in San Luis Gonzales Bay, the largest specimens $1\frac{1}{2}$ inches long.

9. *Argentina sialis* sp. nov.

Resembling *A. elongata*, but with a much deeper body, and a larger eye.

Head 3 inches in length; depth $5\frac{1}{2}$. D. 11; A. 12.

Length of maxillary from tip of snout 4 in head, $1\frac{2}{5}$ in snout. Snout but little longer than eye, $3\frac{1}{6}$ in head; eye $3\frac{1}{2}$; interorbital width 4.

Upper jaw with a narrow band of small teeth borne on the vomer and the front of the palatines, not on the very narrow weak premaxillaries. Lower jaw toothless. Edge of tongue with a series of strong, backwardly-curved teeth, six or eight in number. Gill rakers numerous, slender, rather short, about twenty-five in number below angle of arch.

Front of dorsal fin nearer tip of snout than base of caudal by a distance equaling diameter of pupil. Ventrals inserted behind middle of dorsal, midway between base of caudal and front of orbit, extending but little more than half way to front of anal. Caudal forked.

Scales not spinous, the margins entire, a few only preserved along sides of tail. There were forty or forty-five in a longitudinal series.

Color: Iris, a streak along sides, and sides of head, silvery. Occiput and snout dusky; a black blotch above each eye. Back with eight faint dusky cross-bars. Fins somewhat dusky. Mouth and gill cavity white. Peritoneum black.

A single specimen 3 inches long, from station 3017, in 58 fathoms.

Leuroglossus gen. nov. (*Argentinidae*.)

Ventrals nearly under middle of dorsal. Mandible with a few weak teeth or none. Premaxillaries toothless. A row of stronger teeth on vomer and front of palatines. Tongue, toothless. Pyloric cœca 9.

Appearance of *Argentina*, but the snout shorter, the maxillary reaching front of eye, and the tongue toothless. (Type, *Leuroglossus stilbius* sp. nov.)

10. Leuroglossus stilbius sp. nov.

Body compressed, of moderate depth. Head 3 in length; depth $5\frac{1}{3}$. D. 10; A. 11.

Eye $3\frac{1}{2}$ in head, equaling maxillary, which reaches front of orbit. Snout $3\frac{3}{4}$ in head; interorbital width $4\frac{1}{2}$. Lower jaw projecting. Gill rakers long and numerous. Opercle very thin, membranous. Front of dorsal midway between base of caudal and front of pupil. Ventrals inserted nearly under middle of dorsal, midway between base of caudal and preopercular margin. Front of anal midway between base of caudal and base of ventrals.

The character of the scales can not be determined, as they are wholly lacking in the two specimens obtained.

Color: Sides of head, body, and abdomen right silvery; dorsal region dusted with fine black dots, which become coarser on tail. Snout blue-black. Opercle with steely luster. Upper part of eyeball black. Buccal and gill cavities, and peritoneum jet-black. Fins dusky.

Two specimens, the largest 3 inches long, from stations 2997 and 2998, in 221 and 40 fathoms.

11. Neoconger vermiformis sp. nov.

Body slender, the depth $2\frac{1}{2}$ in length of head. Head $4\frac{1}{2}$ in length of body. Snout anteriorly sharp, slightly projecting beyond the mouth. Mouth small, reaching slightly behind orbit, its cleft $3\frac{1}{2}$ in head. Eye very small, about 9 in head. Posterior nostril immediately in front of middle of eye, the anterior near tip of snout, both without tubes.

Teeth small, conical, in a single row in jaws and on vomer posteriorly; anteriorly on vomer in two series. Gill slits vertical, longer than eye, the two separated by an interspace nearly equal to their length. Tail usually longer than body by a distance equaling length of caudal rays, the body rarely slightly longer than tail.

Dorsal beginning in advance of vent by a distance equaling half length of head. Both dorsal and anal are low anteriorly, but evident,

increasing in height posteriorly, and meeting around end of tail in a well-developed fin. Pectorals well developed, $3\frac{1}{3}$ in head.

Color uniform, yellowish-olive on body and fins, finely dotted with black.

Several specimens taken at station 3035 (30 fathoms); the longest 6 inches.

This species seems to be nearly related to *Leptoconger perlongus* Poey, which has, however, the dorsal beginning much nearer the head, and the anterior nostril tubular.

12. *Ophichthys nothochir* sp. nov.

Closely related to *O. evionthas*, differing chiefly in the obsolescent pectoral fins and in the color, *evionthas* being finely spotted.

Teeth conical, compressed, directed backwards in a single series in jaws and on vomer, smaller in size on the latter; "nasal teeth" in a V-shaped series.

Mouth small, its cleft extending but little behind the eye, its length $2\frac{1}{4}$ in head. Anterior nostrils in a well-developed tube without projecting flap. Posterior nostrils without tube, their posterior end under front of orbit.

Snout 4 in head, the upper jaw projecting for a distance equaling two-thirds the diameter of orbit. Eye half length of snout, its anterior margin over middle of cleft of mouth. Gill slit $6\frac{1}{2}$ in head.

Pectorals nearly obsolete, represented by a small triangular, apparently rayless flap, less than one-third diameter of orbit, and one-fourth gill slit.

Origin of dorsal behind gill slit a distance equaling half that from gill slit to front of eye.

Head and trunk longer than tail by a distance about equaling length of snout. Head $4\frac{1}{3}$ in trunk.

Color: Middle line of back with a series of twelve elliptical yellow spots, their length varying from once to twice the diameter of eye, and separated by wide intervals; each spot is surrounded by a black ring, coalescent below with a large elliptical black blotch on middle of sides, these varying somewhat in size and shape. The intervals between these spots are marked with round black spots about the size of pupil. Similar spots, but larger, are scattered on sides of belly and under side of tail; middle of belly with fainter spots and markings. Head closely covered with round or polygonal black spots about as large as eye, around which are reticulations of light yellow.

Several specimens from San Josef Island, Gulf of California; the largest 14 inches long.

13. *Exocætus xenopterus* sp. nov.

DIAGNOSIS: Snout short, without barbels. Strong bands of teeth on vomer and palatines. Pectorals elongate, nearly reaching base of cau-

dal, the second ray bifid. Ventrals posteriorly inserted. Anal small. Dorsal not elevated. Pectorals uniform black without white markings. Ventrals white, dorsals dusky. Caudal jet-black on basal portion of both lobes, the terminal third abruptly white.

Specific description: Head $4\frac{1}{5}$ in length; depth 6.

D. 13; A. 10. Lat. l., about 45.

Snout short, $3\frac{3}{4}$ in head; mandible scarcely protruding, wide at tip, with a narrow band of small teeth. Teeth along edge of premaxillaries in a single series. Vomer with a narrow patch, palatines with a wide patch of well-developed teeth, similar to those in jaws. No teeth on tongue.

Preorbital about as wide as pupil; distance from tip of snout to end of maxillary equals length of snout. Eye large, $3\frac{1}{4}$ in head. Interorbital width 3 in head.

Distance from front of dorsal to base of middle of caudal rays equals half its distance from posterior margin of pupil. Length of dorsal base equals two-thirds length of head, the highest ray $2\frac{2}{3}$ in head.

Origin of anal under middle of dorsal, its base equaling snout and half eye, the last ray nearly under last dorsal ray. Lower lobe of caudal $3\frac{1}{2}$ in length; the upper slightly less than head. Origin of ventrals half way between base of caudal and preopercular margin, the tip reaching base of third anal ray, a trifle shorter than head.

First pectoral ray five-eighths the longest; second ray deeply forked, the third and fourth apparently the longest (the tips slightly mutilated.) The fin extends beyond dorsal, and falls short of the caudal by a trifle.

Color in spirits: Black above, becoming abruptly silvery on middle of sides. Pectorals jet-black within, overlaid by some silvery luster without. Median ventral rays black, the inner and outer white. Dorsal dusky, without distinctive marks. Anal white. Caudal black on basal portion of both lobes, the remaining third white.

A single specimen, $9\frac{1}{2}$ inches long, in good state of preservation, taken from a booby-bird on Clarion Island.

14. *Melamphaës lugubris* sp. nov.

Head very broad and heavy, the snout extremely broad and short, its anterior profile nearly vertical. Mouth very oblique, the lower jaw protruding beyond the upper, the premaxillaries anteriorly on level of lower margin of pupil, the maxillary reaching vertical from its posterior margin, $2\frac{2}{3}$ in head; snout $4\frac{1}{2}$, its width equaling the length of snout and eye; interorbital width $2\frac{2}{3}$; eye $6\frac{1}{2}$.

Teeth minute, uniform, in a single series in upper jaw and in front of mandible, the lower jaw laterally with a narrow band. Vomer and palatines toothless.

Interorbital space strongly convex, as well as rest of head deeply excavated for mucous canals, which are covered with a very delicate integument conspicuously marked with fine parallel or radiating striæ.

The bones are firm and cartilaginous, not papery or with thin membranous expansions as in other related species.

Margins of preopercle entire, the bone firm, the posterior angle scarcely produced, evenly rounded, the margin nearly vertical. No evident ridge on opercle, which terminates posteriorly in a flexible rounded process without spine. Mandibles meeting along median line posteriorly, but not forming a ridge. Gill rakers as long as eye, slender, about 14 below angle.

Dorsal spines very weak, the third half as high as first soft ray. Posterior line of occiput midway between tip of snout and origin of dorsal. Base of dorsal equals length of head behind middle of eye. Anal small, its origin under base of last dorsal ray, the length of its base equaling half interorbital width. Spine slender, about two-thirds longest soft ray. Caudal mutilated, apparently forked. Pectorals long, slender, falcate, with fourteen rays, the longest $1\frac{2}{3}$ in head. Ventrals not reaching vent, with one spine and seven or eight soft rays, the longest two in head.

Scales large, caducous, with entire edges, covering the opercles but lacking elsewhere on head.

D. III, 15; A. I, 8. Lat. 1. 26.

Color: Uniform brownish-black, the fins dusky. Mouth, gill-cavity, and peritoneum black.

A single specimen, $3\frac{1}{2}$ inches long, from Station 2923, in 822 fathoms.

This species resembles very closely *M. typhlops*, as figured by Gunther (Deep-Sea Fishes, Challenger, Pl. V., fig. A). In *typhlops* the mouth is evidently larger, and the species is described as having six dorsal spines and eleven rays, although the artist has represented it with D. III, 14.

I am unable to ascertain to what extent *lugubris* approximates *Plectromus suborbitalis* Gill, as the description of the latter contains nothing of specific value except the number of the fin rays.

15. *Melamphaës cristiceps* sp. nov.

System of mucous canals on head highly developed, their margins raised into high thin crests, usually with undulating margins and more or less serrulated. A rather long, sharp, slender spine, directed upwards and forwards on middle of snout. Two or three spines at lower posterior angle of cheek; marginal portion of preopercle extremely thin and flexible, its lower limb sharply serrated. From the upper anterior angle of opercle two ridges diverge, the one running backwards terminating in a spinous point. Opercular margin serrulate.

Mandibles meeting on median line below, their edges produced to form a conspicuous median crest. Their lateral margins form membranous wings which combine with similar prolongations from the sub-orbital bones to overlap the cleft of the mouth.

Head long, $2\frac{3}{5}$ in length; depth, $3\frac{3}{5}$; length of caudal peduncle, $4\frac{1}{5}$. Greatest depth of caudal peduncle, one-half its length. Head narrower than in *M. lugubris*, its anterior profile descending more gradually. Mouth less oblique, the lower jaw included, the maxillary extending behind eye, $2\frac{1}{4}$ in head; snout, $4\frac{1}{3}$; interorbital width, $2\frac{4}{5}$; eye, $7\frac{1}{2}$.

Teeth minute, equal in a single series in both jaws. Vomer and palatines toothless. Gill-rakers long, broad at base, compressed, weak, about fifteen below angle.

Posterior line of occiput slightly nearer front of dorsal than end of snout; length of fin equaling its distance from base of caudal. Spines slender, pungent, weak. Origin of anal under the fourth from the last ray of dorsal, the length of its base scarcely exceeding length of snout. Anal spines rather strong, the two intimately soldered together, their outlines distinct.

D. III, 13; A. II, 9.

Pectorals long, $1\frac{1}{2}$ in head. Ventrals I, 7 or I, 8.

The scales are entirely lost; they were, however, large and must have been about twenty-three in number, judging from the impressions on the skin.

Color: Black anteriorly, brownish-black behind. Mouth, gill-cavity, and peritoneum jet-black. Fins all blackish.

One specimen 5 inches long, from Station 3075, in 859 fathoms.

16. *Serranus æquidens* sp. nov.

Body slender, the head very long, the caudal peduncle narrow. Tip of lower jaw but little projecting; mouth large, the maxillary reaching vertical from posterior margin of pupil, $2\frac{1}{3}$ in head. Upper jaw with teeth laterally in a single series, becoming double anteriorly; the outer teeth are larger and spaced but not canine-like; the inner are close set, small, directed inwards; the median pair of teeth of inner series are larger than the others and directed backwards. Teeth of lower jaw in a single series forming a very narrow patch at symphysis. Teeth in a narrow patch on vomer, the posterior enlarged almost canine-like, directed backwards; on palatines in an irregular double series.

Eye large, as long as snout, $4\frac{1}{2}$ in head. Interorbital space flat, its width three-fifths orbit. Preorbital narrow, one-fourth orbit. Angle of preopercle slightly projecting, the vertical margin gently concave; teeth minute and equal on both limbs and at angle. Opercle greatly produced backwards, reaching much beyond inner edge of shoulder-girdle, the margin of preopercle equidistant between front of eye and end of opercular flap. Opercle with a single spine, the lower not developed. No spine on shoulder.

Gill-rakers long and slender, sixteen in number on anterior limb of arch, the longest one-half the diameter of the large eye.

Dorsal with weak, flexible, low spines, which increase in length the fourth (two-sevenths length of head), then decrease to the ninth, which

is less than one-half the fourth, the tenth again longer. Dorsal rays slender, little forked, the longest less than highest spine. Caudal deeply lunate. Anal short, with slender rays, the margin not rounded, the anterior rays longest, the posterior but little shortened.

Anal spines slender, graduated, the third scarcely two-thirds height of first soft ray.

Ventrals inserted well in advance of base of pectorals, not nearly reaching vent, one-half-head. Pectorals long and narrow, reaching front of anal, with narrow scaly base, the posterior margin obliquely truncate or somewhat *f*-shaped in the spread fin, the lower rays slightly longer than upper, the middle rays shortest.

Scales large, ctenoid, a wide rough area within the spinous margin. Cheeks and opercles scaled, the scales on opercles larger than elsewhere. Top of head scaled as far forward as posterior margin of pupil. Caudal fin scaled at base of lobes. Fins otherwise without scales. Lateral line running high and descending gradually to middle of caudal peduncle.

Head, $2\frac{1}{3}$ in length; depth, $3\frac{1}{2}$; depth of caudal peduncle equaling diameter of orbit. D. IX, I, 12; A. III, 7. Lat. l. 48, $4\frac{1}{2}$ series above it, thirteen between lat. l. and front of anal. Five series of scales on cheeks parallel with posterior margin of orbit.

Color in spirits: Dusky-brownish above, lighter below; a series of about seven ill-defined dusky blotches along lateral line, from which still fainter bars run downwards, soon disappearing. Lining of opercle largely black; this apparent as a dusky blotch externally. Vertical fins transparent, minutely punctate with black. Median rays of ventrals black, the outer and inner whitish. Peritoneum silvery-white. No very conspicuous marks on body or fins.

A single specimen about 7 inches long, from Station 2996, in 112 fathoms.

This species belongs to the subgenus *Prionodes*.

17. *Pronotogrammus eos* sp. nov.

DIAGNOSIS: Interorbital and maxillary naked, the former concave. Preopercular margin serrate, other bones of head entire. None of dorsal spines elongated or filamentous. Eye very large. None of the fins greatly produced.

Specific description: Body elongate, tapering regularly backwards from shoulder, the lower outline nearly straight; head thick; mouth terminal, oblique, the mandible laterally included, its tip fitting into an emargination of premaxillaries, not entering profile. Maxillary without supplemental bone, broad, reaching vertical from middle of pupil, $2\frac{1}{3}$ to $2\frac{1}{2}$ in length.

Teeth in upper jaw in a narrow villiform band, the outer series slightly enlarged, and with one or two strong canines directed forwards and outwards. Teeth in mandible small, in a single series, a pair of

anterior canines directed forwards and outwards, and a second pair on sides of jaw directed backwards and inwards. Teeth in rather broad bands on vomer and palatines; none on tongue.

Interorbital space gently concave, the supraocular ridges slightly elevated, its width but little more than half diameter of orbit. Preorbital narrow, its width above middle of maxillary one-third pupil. Eye very large, 3 in head, much longer than snout.

Vertical limb of preopercle usually with a slight emargination above the angle (in adults), the angle itself and a region above the emargination slightly projecting. Teeth of vertical limb fine, equal; those of angle coarser, those below again fine, directed backwards; notch above angle usually smooth when present. Two flat spines on opercle; other bones of head entire. Gill rakers long, slender, close-set, about thirty on anterior limb of arch, the longest one-half orbit.

Dorsal emarginate; the spines slender, pungent, not flexible, none of them produced or filamentous, each with a short membranous flap behind its tip; spines gradually increasing in height to the sixth, which is contained $3\frac{1}{3}$ times in head; the tenth is shorter than any other except the first and second, and is two-thirds the sixth. Soft dorsal high, some of the posterior rays highest, not reaching base of caudal, 2 to $2\frac{1}{2}$ in head.

Anal similar to soft dorsal, its posterior rays in advance of end of dorsal; second anal spine stronger but shorter than third, the length of which is $3\frac{1}{5}$ in head.

Ventrals inserted slightly in advance of base of pectorals, the outer rays somewhat produced, reaching beyond vent and usually to or slightly beyond front of anal.

Caudal forked, the middle rays two-thirds the length of the outer, which are not produced. Pectorals short, reaching slightly beyond front of anal.

Scales large, ctenoid, on both head and body; on top of head the scales cover occiput and send a V-shaped patch to above middle of orbits; the rest of interorbital space, the snout, maxillary, preopercle, branchiostegal membranes, and anterior half of mandibles naked. Scales on cheeks in six rows; those on opercles larger. All but the central rays of caudal fin well scaled. Dorsals and anal naked. Pectoral and ventrals scaly on basal portion.

Lateral line running very high, under end of spinous dorsal separated from dorsal outline by less than three full series of scales. Under end of soft dorsal it regains somewhat abruptly middle of sides and runs straight thence to base of tail.

D. X., 15; A. III, 8. Lat. l. 38. Head, $2\frac{1}{2}$ to $2\frac{3}{5}$ in length; depth, $2\frac{1}{5}$ to 3.

Color: Rosy red, overlying silvery on sides, and below the fins light yellow. A dusky spot above the middle of each orbit, and two V-shaped olive-brown marks behind the head, one from nape downward and back-

ward on each side to upper angle of gill openings, the second parallel with it, starting from origin of dorsal. Lining of buccal and gill cavities, and peritoneum silvery white.

Numerous specimens from station 2996 (112 fathoms), the largest 7 inches long.

18. *Micropogon megalops* sp. nov.

Depth, $4\frac{3}{5}$ in length; head, 4; maxillary reaching vertical from middle of pupil, $2\frac{7}{8}$ in head; snout, $3\frac{3}{5}$, equaling interorbital width; width of preorbital, $1\frac{1}{2}$ in snout. Eye very large, a trifle less than snout, 4 to $4\frac{1}{4}$ in head. Outer series of teeth in upper jaw little enlarged. Preopercular spines very strong, arranged as usual in this genus. Gill-rakers all short, 9 above the angle, 16 below.

Dorsal spines stronger than in *M. ectenes*, the third the longest, barely reaching origin of soft dorsal when depressed, equaling length of snout and eye. Caudal, double truncate. Second anal spine strong, $2\frac{1}{2}$ to 3 in head. Outer ventral ray slightly produced, $1\frac{2}{3}$ in head. Pectorals extending beyond ventrals, $1\frac{2}{5}$ in head.

D: X. I., 27 to 29; A. II, 7; lat., l. $50\frac{7}{14}$.

Scales of a moderate size, seven in a vertical series between lateral line and base of dorsal.

Coloration as usual in this genus; no conspicuous oblique streaks following rows of scales above the lateral line. Axil and base of pectorals blackish. Lining of gill cavity more extensively black than in other species, the branchiostegal membrane and opercular flap abruptly silvery white within.

Four specimens were obtained from station 3021 (14 fathoms), the largest 10 inches long.

19. *Cynoscion macdonaldi* sp. nov.

Snout sharp; lower jaw protruding. Mouth moderate, somewhat oblique, the maxillary reaching vertical from middle of orbit, $2\frac{2}{5}$ in head. No enlarged canines on either jaw.

Teeth in front of premaxillaries mainly in two distant rows, uniting laterally to form a narrow band. The inner row is composed of smaller teeth directed downward and backward, the outer series of stronger conical teeth, a few scattering teeth between the two rows. Teeth in the lower jaw in a narrow, irregular double series.

Eye small, $5\frac{1}{4}$ in head; snout $4\frac{2}{5}$. Both vertical and horizontal limbs of preopercle minutely serrulate. Opercle ending in a flattened process showing two short spinous points. Gill rakers about two-thirds diameter of pupil, strong, toothed, two above angle, ten below.

Scales very strongly ctenoid, becoming greatly reduced on nape, about twenty-five transverse series between occiput and front of dorsal. A narrow, definite, scaly sheath at base of dorsal and anal; these fins otherwise naked. Caudal scaled for a short distance on basal portion. Scales above lateral line rapidly increasing in size backwards, thirteen

in a transverse series between lateral line and front of dorsal. Lateral line with from fifty to fifty-five pores, the scales above it in about eighty-five to ninety transverse series.

Dorsal spines low and weak, the rays not high, the longest $3\frac{1}{2}$ in head. Second anal spine slender but not flexible, its length $1\frac{1}{2}$ in soft rays. Caudal double truncate, the median rays much produced, equaling length of head behind snout. Ventrals $1\frac{1}{2}$ in head; pectorals short, scarcely reaching tips of ventrals, $1\frac{1}{2}$ in head.

D. X, I, 25; A. II, 7. Head $3\frac{2}{3}$ in length; depth, 4.

Color: Dusky-silvery, with coarse black specks along lower part of head and sides; upper half of sides with many irregular blackish spots or blotches, showing little or no tendency to form streaks. Dorsals dusky, the basal portion with small black spots. Other fins blackish; the caudal lighter at base; mouth white within; lining of gill cavity black, becoming yellow on lining of branchiostegal membranes.

Adult.—The above description is from a young example $10\frac{1}{2}$ inches long, dredged at station 3030 in 20 fathoms. An adult, about 4 feet long, agrees with this, except in the following details:

Maxillary $2\frac{3}{5}$ in head, reaching vertical from behind eye. Eye 12 in head. Preopercle entire. Opercle emarginate behind, without evident spinous points. Gill rakers short and exceedingly strong, equaling diameter of pupil, 1 movable one above angle, nine below.

Scales on nape very closely imbricated, the exposed portions very narrow. They are in somewhat irregular series, there being from thirty-five to forty scales in a line between front of dorsal and occiput.

Highest dorsal spine $3\frac{1}{2}$ in head. D. IX-I, 24; A. II, 7. Caudal gently rounded posteriorly, the longest ray one-half in head. Pectorals long, narrow and falcate, reaching much beyond ventrals, $1\frac{1}{2}$ in head.

Color: Bluish above, dusky silvery on sides and below. No evident black spots or blotches on body or fins. Vertical fins blackish, paired fins dusky.

This species is very abundant along the entire eastern shore of the Gulf of California, and congregates in great numbers near the mouth of the Colorado River. It enters the river and is found feeding in shallow water near the shore, where it is easily approached and speared. At the head of the Gulf it is known as the sea bass, while in the vicinity of Guaymas it is goes by the native name of "Totuava." It does not seem to be known at La Paz, and was not seen by us on the western side of the Gulf. Many specimens were taken by hand-lines at the head of the Gulf, the largest weighing 172 pounds. Large specimens were also seen at Guaymas and at the mouth of the Rio del Fuerte. At Guaymas it is said to be a winter visitant, unknown during the summer months.

20. *Pseudojulis adustus* sp. nov.

Color in spirits: Everywhere warm brown, darker on the bases of the scales; pectorals lighter; other fins black, the soft dorsal, anal, and caudal, with a narrow white margin broader at tips of outer caudal rays. In one specimen there are traces of wavy lines on head, perhaps blue in life.

Head 3 in length; depth $2\frac{2}{3}$. Caudal peduncle $1\frac{2}{3}$ in length of head; snout 3. Eye $2\frac{1}{2}$ in snout. Four canines in lower jaw, two in the upper, directed very obliquely forwards.

Scales not continued over median line of nape, seven or eight in front of dorsal. Seven or eight series of scales on breast. No scaly sheaths at bases of dorsal or anal.

Caudal rounded, the outer rays not at all produced, $1\frac{3}{4}$ in head. Ventrals rather long, reaching nearly to vent, the inner rays $1\frac{2}{3}$ in the outer. Pectorals $1\frac{2}{7}$ in head.

D. IX, 13; A. III, 12. Lat. 1. 27. Dorsal spines pungent.

Three specimens from Socorro Island, the longest 9 inches long.

21. *Pseudojulis melanotis* sp. nov.

Color in spirits: Light olivaceous, the back and upper part of sides with seven broad dusky cross-bars; the light interspaces less than half their width; these bars are distinct along dorsal outline, but are not continued on the dorsal fin; they become partly interrupted along dorsal portion of lateral line anteriorly, to become most prominent along middle of sides. The first bar is on the nape, the second under anterior dorsal spines. A dusky streak from eye forwards to snout, and another backwards towards opercular angle. Opercular flap with a jet-black spot, widely margined posteriorly with white. A round black spot at base of caudal, above the median rays. A dusky spot on each side above vent, in front of which are two short parallel silvery lines running obliquely downwards and forwards; faint traces of about four other silvery lines in front of these and running parallel with them. A small jet-black spot on membrane between first and second dorsal spines. Fins otherwise translucent, unmarked.

Body rather slender, depth $4\frac{2}{3}$ in length; head $3\frac{3}{4}$. Snout $3\frac{3}{4}$ in head; eye $4\frac{1}{3}$, equaling length of maxillary. Two anterior canines in each jaw. Posterior canines not developed.

Dorsal spines flexible, but pungent, the soft rays $2\frac{1}{3}$ in head. Caudal rounded, the outer rays not at all produced. Pectorals and ventrals short, the outer ventral rays not produced, not reaching vent. Pectorals $1\frac{2}{3}$ in head.

D. IX, 12; A. III, 12. Lat. line 26.

Scales not crossing median line of nape, much reduced on its anterior portion, in eight oblique rows. Scales on breast small, in nine rows. No scaly sheaths to fins.

A single specimen, $2\frac{3}{4}$ inches long, from Station 2825.

22. *Pseudojulis inornatus* sp. nov.

Color in spirits: Nearly uniform olivaceous; a faint dark streak forwards from eye to end of maxillary; a dark spot on each scale along base of dorsal, forming a faint dark streak. Scales along lower half of sides edged with whitish (probably blue in life). Spinous dorsal dusky, a small black spot at base of fifth ray, another at base of last ray. Fins otherwise translucent, unmarked. Iris bright silvery.

Body very slender; depth $5\frac{2}{3}$ in length; head $3\frac{1}{2}$; depth of caudal peduncle $11\frac{1}{3}$; snout $3\frac{1}{5}$ in head; maxillary $4\frac{2}{3}$; equaling diameter of orbit, which is $1\frac{3}{5}$ in snout, and equals interorbital width.

Two canines only in front of each jaw. No posterior canines.

Distance from front of dorsal to occiput equaling distance from latter to front of eye. Dorsal spines slender and flexible. Longest soft ray $2\frac{3}{5}$ in head. Caudal truncate, the outer rays not produced, $1\frac{3}{4}$ in head. Pectorals and ventrals very short, the outer ray of the latter not at all produced. Pectorals 2 in head; ventrals $2\frac{3}{5}$, not nearly reaching vent.

D. IX, 11; A. III, 12. Lat. 1, $27\frac{1\frac{1}{2}}{10}$.

Scales not continuous across median line of nape, six series in front of dorsal. Scales on breast much reduced; ten oblique series in front of ventrals; eighteen scales along dorsal portion of lateral line. No scaly sheaths along bases of fins.

A single specimen, $3\frac{1}{2}$ inches long, from Station 2829.

23. *Halichceres sellifer* sp. nov.

Red, each scale on sides with a vertical blue line, those anteriorly narrowly margined with violet; upper part of cheeks and opercles with irregular blue lines and spots. A conspicuous black blotch on back between fourth and seventh dorsal spines, extending upwards on fin, and rapidly narrowing to middle of sides, where it disappears. Dorsal and caudal reddish or orange, the dorsal with oblique broken lines of blue, and a narrow blue margin, the caudal with a few blue spots at base. Anal violet at base, yellowish on distal half, narrowly margined with blue, with a wavy blue median line, and a series of broken blue lines at base. Pectorals and ventrals light orange, without distinguishing marks.

Head equals depth, $3\frac{1}{4}$ in length. Caudal peduncle about one-half head. Maxillary $3\frac{1}{3}$ in head; snout $2\frac{3}{5}$; interorbital space 5. Eye 3 in snout. Interopercles not meeting below throat.

Two strong canines in front of upper jaw, four in front of mandible. A strong posterior canine tooth in upper jaw, at angle of mouth.

Scales somewhat reduced on breast and nape, those on nape not crossing median line, arranged in five or six oblique series; eight or nine series of scales before ventrals. No scaly sheaths along bases of dorsal and anal fins.

Caudal truncate or slightly emarginate, the outer rays scarcely produced. Outer ventrals rays produced, reaching vent, twice as long as inner rays.

D. IX, 11; A. III, 12. Dorsal spines pungent. Pectorals $1\frac{1}{2}$ in head. Lat. 1. 28.

A single specimen, $11\frac{1}{2}$ inches long, from Clarion Island.

24. *Thalassoma virens* sp. nov.

Uniform bright green, without distinguishing streaks or spots on head or body.

Head 3 in length; depth $2\frac{3}{4}$ to 4; depth of head $1\frac{1}{4}$ in its length; maxillary $3\frac{1}{2}$ in head: snout $2\frac{2}{5}$ to $2\frac{3}{5}$; eye $3\frac{1}{3}$ in snout; interorbital width half snout.

Two strong canines in front of each jaw, the other teeth increasing in length anteriorly, but not nearly equaling anterior pair. No posterior canines.

Scales on breast and nape reduced in size, the latter continuous over the median line of nape, in about seven rows in front of dorsal. About ten oblique rows on breast; twenty-seven or twenty-eight transverse rows on sides. Two full series of scales above lateral line, and four or five small scales along base of fin.

Depth of caudal peduncle $2\frac{1}{5}$ in head. Outer caudal lobes greatly produced, $1\frac{1}{3}$ in head, the middle portion truncate, one-half length of head. Outer ventral rays produced, but not nearly reaching anal; twice the length of the inner rays, half length of head. Pectorals $1\frac{2}{5}$ in head.

D. VIII, 13; A. III, 11. Dorsal spines strong, pungent.

Very abundant at Socorro Island; the largest specimen seen, 13 inches long.

25. *Thalassoma grammaticum* sp. nov.

Bright green, each scale of sides with a purplish bar at base. Head, nape, breast, and belly purplish; the head with four green streaks on each side margined narrowly with brown. The lowermost bar runs on mandible, lower preopercular margin, and interopercle; the second runs from mandibular articulation across cheek and subopercle, showing a strong upward curve below eye; the third is nearly parallel with the second, running from angle of mouth to opercular margin, passing through lower margin of orbit; the fourth runs backwards from orbit to upper posterior angle of opercle, then downwards along margin of opercle to base of pectoral. These streaks are continued backwards more or less as wavy green streaks on breast and sides below pectorals. Dorsal and anal purplish with a wide terminal green bar nearly half as wide as fin. Upper and lower caudal rays purplish, the median rays light. Pectorals and ventrals light purplish. A small black blotch on base of pectorals above.

Head $3\frac{1}{2}$ to $3\frac{3}{4}$ in length; depth 3 to $3\frac{1}{2}$; maxillary $4\frac{1}{2}$ in head; snout 3; interorbital width 4. Eye $2\frac{1}{2}$ in snout. Two canines in front of each jaw; no posterior canines; teeth gradually enlarging towards front of each jaw, those next the anterior pair not more than two-thirds their length. Interopercles greatly produced, meeting or overlapping on median line below.

Scales somewhat reduced on nape and breast, continuous over median line of nape. Seven or eight oblique rows in front of dorsal, nine or ten series in front of ventrals. Well-defined sheaths at base of dorsal and anal.

Caudal fin very deeply lunate, the outer rays greatly produced, forming lobes nearly twice as long as median rays in the adult, but little produced in the young. Outer ventral rays produced, not quite twice length of inner rays, not reaching vent. Pectorals $1\frac{1}{3}$ in head.

D. VIII, 13; A. III, 11. Dorsal spines pungent.

Abundant at Socorro Island; a single specimen from Clarion Island, the largest obtained, $11\frac{1}{2}$ inches long.

26. *Thalassoma socorroense* sp. nov.

Deep brown, each scale on sides with a vertical bluish bar at base, narrowly margined with light blue. Sides of head thickly covered with small purplish or bluish spots and broken lines margined with darker blue, those on cheeks arranged in lines radiating from the eye. Dorsal and anal purplish, a submarginal light streak (probably blue in life), and a narrow white margin. A black blotch on anterior rays of spinous dorsal. Pectorals and ventrals purplish at base, with more or less orange or yellow on distal portion. Caudal brownish, the outer rays tipped with black.

Head equaling depth, 3 to $3\frac{1}{4}$ in length; depth of caudal peduncle $2\frac{1}{5}$ in head; maxillary $3\frac{1}{2}$; snout $2\frac{2}{3}$; interorbital $4\frac{1}{3}$. Eye 3 inches in snout. Interopercles meeting below on median line of throat.

Scales reduced on breast and nape, the latter scaled over median line; eight or nine scales in a row along nape, arranged in five or six oblique series; thirteen oblique rows on breast. Well developed scaly sheaths along bases of dorsal and anal, and series of scales running out on membranes between rays of caudal.

Outer caudal rays little produced, the outline of fin gently concave. The longest ray equals length of head in front of preopercular margin. Ventrals short, the outer rays not produced, the inner rays contained $1\frac{2}{3}$ in length of outer. Pectorals short and broad, $1\frac{3}{4}$ in head. Dorsal spines strong and sharp.

D. VIII, 13; A. III, 11; Lat. l., 27.

Abundant at Socorro Island; the longest specimen $10\frac{1}{2}$ inches.

Calotomus gen. nov.

Teeth distinct, equal, imbricated, arranged in regular oblique rows in both jaws, wholly concealing the dental plate, to the anterior surface of which they are affixed. Cutting edge of both jaws formed by the outer teeth, the dental plate not reaching edge, and visible only from within.

Lips double for a short distance only next the angle. Scales on cheeks in one row. Lateral line continuous. Bases of dorsal and anal fins with scaly sheaths. Dorsal spines nine, soft and flexible. Gill membranes broadly joined to the isthmus.

This genus differs from *Cryptotomus* in the distinct and regularly imbricated teeth, similar in both jaws. Bleeker may have used the name *Calliodon* in this sense, but the type of *Calliodon* (*C. lineatus*) is almost certainly a *Scarus*, and the name is therefore not available.

Type, *Calotomus xenodon* sp. nov.

27. Calotomus xenodon sp. nov.

Body deep, compressed, the depth $2\frac{2}{5}$ in length; head, $3\frac{1}{3}$; snout short and convex, $2\frac{2}{5}$ in head; interorbital width, 4; maxillary, $3\frac{1}{4}$; eye, $2\frac{1}{3}$ in snout.

Teeth pointed, imbricated in quincunx order, both tips and edges wholly free, the anterior face convex, the posterior face alone adnate to the dental plate. They are of equal size and similar in both jaws, there being three or four teeth in an oblique cross-series anteriorly, about twelve of these series in the upper jaw, and fourteen in the lower. Two teeth in the upper jaw at the angle of the mouth are conical and curved downwards and backwards.

Scales on cheeks in a single series, three or four in number. Four scales on median line before dorsal fin, the anterior one encroaching on occiput. Scales on breast not reduced, three on median line before ventrals, one and one-half series of scales between lateral line and dorsal, the half series forming a sheath along base of fin.

D. IX, 10; A. III, 9. Scales $25\frac{1\frac{1}{2}}{7}$.

Dorsal spines rather high and flexible, the origin of fin over base of pectorals. Caudal deeply lunate, the outer rays produced, one-third longer than the middle rays, $1\frac{1}{4}$ in head. None of the ventral rays elongate, the fin reaching about half way to vent, $1\frac{1}{5}$ in head. Pectorals with wide oblique base, the free margin of fin somewhat *f*-shaped, the upper angle acute, the lower rounded, the longest ray $1\frac{1}{3}$ in head.

Color: Mottled silvery, slaty, and brown, without definite pattern. Top of head and snout dusky. Pectorals black at base. Ventrals dusky at tip. Dorsal and anal black on basal half, mottled distally. Caudal mottled, narrowly edged behind with white.

Two specimens from Socorro Island, the longest 14 inches long.

28. *Microspathodon cinereus* sp. nov.

This species apparently differs from the type of *Microspathodon* in the production of its dorsal, anal, and caudal lobes to form filaments, and to some extent in the dentition. It may be necessary to consider it the type of a distinct genus.

Body deep, compressed, the nape high and compressed, the anterior profile very steep, slightly concave in front of orbits. Head very wide and heavy below, mouth wide, transverse, its width nearly twice its lateral cleft, the maxillary reaching vertical from midway between nostril and front of eye. Maxillary almost wholly slipping under the broad preorbital, its distal half strongly U-shaped, with the convexity backwards, and its anterior margin displaying a deep re-entrant curve.

Dentary portion of mandible consisting of an anterior transverse portion, and the two lateral limbs, which form about a right angle with anterior portion, and are convexly bent towards median line. It would much resemble a U with the lateral limbs convex inwards instead of outwards. The anterior portion is provided with a single series of rather firmly fixed elongate incisor teeth with truncate edges; the lateral teeth are similar but smaller.

Teeth in the upper jaw strongly compressed laterally, but with the extreme tip flattened antero-posteriorly, so as to render them narrow incisors. They are very loosely implanted, extremely movable, and are in a single functional series, the teeth of which are replaced by others which appear above along front of jaw. Between vomer and front of jaw is a median firm fleshy pad, with free anterior margins; a somewhat similar pad at each angle of mouth. No teeth on vomer or palatines.

Nostril single, round, midway between front of jaw and middle of orbit. Eye small, high, its diameter $2\frac{1}{3}$ in width of preorbital, 5 in head. Preopercle smooth or minutely crenate at the angle; none of the bones of head serrate or spinous. Gills $3\frac{1}{2}$, the inner half of fourth gill developed about one-fourth length of others. A small but evident pore behind fourth gill. Gill-rakers short and weak, not toothed, about twenty on anterior limb of outer arch. Gill membranes forming a broad fold across the isthmus.

Fins entirely enveloped in scales, which are large at base of fins, becoming minute on soft portions. Dorsal spines strong, regularly increasing, the highest $2\frac{1}{2}$ in head. Anal spines strong, the second but little shorter than longest dorsal spines. Soft dorsal and anal fins conspicuously falcate, the median rays of fins produced beyond fork of caudal, the anterior margins strongly convex, the posterior strongly concave. Longest dorsal and anal rays more than half length. Caudal deeply forked, the lobes also greatly falcate, equaling in length the lobes of dorsal and anal. Outer ventral rays produced, extending beyond front of anal. Pectorals short, rounded, reaching vertical from vent.

Scales large, rough, vertically much deeper than wide, with numerous small accessory scales at base which become exceedingly numerous on head and nape, where they form a shagreen-like covering. Lateral line little prominent, the pores opening on under surface of scales, ceasing under last rays of soft dorsal.

Head, $3\frac{1}{4}$ in length; depth, one-half length to tip of median caudal rays. D. XII, 16; A. II, 14. Lat. l. 29 (twenty-two pores).

Color: Uniform slaty gray, the fins somewhat darker, all but spinous dorsal narrowly white-margined. Peritoneum gray.

Abundant on rocky reefs at Clarion and Socorro Island; a single specimen secured, about 7 inches long.

29. *Holacanthus clarionensis* sp. nov.

Preopercular spine gently curved, its outer face channeled, the spine fitting into a groove in front of base of pectoral, $2\frac{1}{2}$ in head, not reaching vertical from margin of opercle. Vertical limb of preopercle with twenty to twenty-five short strong spines; horizontal limb with two spines pointing backwards; the anterior portion of margin of interopercle with two strong spines; from one to three smaller spines behind these. Preorbital with a strong compressed blunt spine directed forwards, and two sharp ones below it. Posterior margin of subopercle with a series of short spines. No opercular spines.

Anterior profile very slightly concave above orbits, the snout not protruding; maxillary 4 in head. Eye small, little more than half snout, $4\frac{1}{2}$ in head, $1\frac{1}{2}$ in interorbital width.

Head, 4 in length; depth, $1\frac{7}{8}$. D. XIV, 18; A. III, 18.

Membrane of first dorsal spine free from scales; of second and third, partly scaly; other spines with membranes wholly scaled. Length of fourteenth spine $2\frac{1}{5}$ in head. Soft dorsal and anal not produced, the angles rounded, the posterior margins inclined but slightly forwards, and about on vertical of base of caudal. Longest rays of dorsal and anal equal, $1\frac{1}{4}$ in head. Caudal truncate when widely spread, the angles not rounded, the outer rays not at all produced, about equaling length of head; pectorals and ventrals about equal, equaling length of head, the ventrals with outer rays slightly produced, reaching to or slightly beyond vent.

Scales large, everywhere covered with small basal accessory scales, all rough-ctenoid. Lateral line much arched, concurrent with the back, incomplete, ending under middle of soft dorsal, with only 35 pores.

Color: Head and body very dark olive-brown, a wide orange-red bar behind head, including nape and back as far as sixth dorsal spine, becoming narrow on middle of sides, and expanding again below to include region from gill openings nearly to vent, being here, however, darker and less distinctly defined. The yellowish color continues backwards as a submarginal band on dorsal and anal, the margin being deep blue, broader posteriorly. Caudal bright orange-red, with

very narrow blue margin. Pectorals yellowish. Ventrals yellowish-olive. Vertical fins otherwise with color of sides.

This brilliant species is extremely abundant at Clarion, Socorro, and San Benedicto Islands. It reaches a length of about 7 inches.

30. *Gobius zebra* sp. nov.

Body not elongate, the snout short, the mouth oblique, with maxillary reaching below middle of orbit.

Head 3 in length; depth $4\frac{1}{3}$. D. VI, 11 or 12; A. 9. L. one-half inch.

Mouth small, the maxillary $2\frac{1}{2}$ in head. Interorbital space very narrow. Eye $3\frac{1}{4}$ in head. Teeth in upper jaw in a narrow band or double series, the outer row enlarged and spaced. Lower jaw apparently with a single series, similar to the outer row in the upper jaw.

Scales cycloid, large, wanting on nape and a narrow strip along base of spinous dorsal.

Color: Cherry-red, head and sides with fifteen blue cross-bars, a little narrower than interspaces, encircling body posteriorly, lacking for a short distance on belly and under side of head. On upper side of head and nape these bars run obliquely forwards and downwards, but are elsewhere vertical. On middle of each interspace a very narrow blue line, becoming indistinct on lower part of sides. On cheeks the blue bars are connected by narrow cross-lines forming blue reticulations surrounding round spots of the ground color.

Two specimens from Station 2,989, in 36 fathoms.

31. *Gobius dalli* sp. nov.

Resembling species of *Microgobius*. With short compressed body, high head, and moderate, very oblique mouth; upper pectoral rays normal; scales ctenoid, of moderate size; anterior dorsal spines much produced.

Head $3\frac{2}{3}$ in length; depth $4\frac{1}{3}$. D. VI-17; A. 14. Lat. l. 40.

Mouth very oblique, the maxillary reaching vertical from front of pupil, $2\frac{1}{2}$ in length of head. Snout short, two-thirds diameter of orbit, which is 3 in head. Jaws with an outer series of long, distant, canine-like teeth, and an inner series or a narrow band of minute teeth.

Dorsal spines six, the two anterior greatly elongate, not free, in our largest specimen extending beyond middle of soft dorsal. Membrane from last dorsal spine reaching to, or nearly to, base of first soft ray. Soft dorsal rather high, the fin long. Caudal rounded, less than length of head. Ventrals free from belly, fully united. Pectorals short, the upper rays not free nor silk-like.

Scales of moderate size, ctenoid, covering entire trunk, with possible exception of the nape. The scales are readily caducous, and are lacking on nape and frequently on anterior third of body in our specimens.

Color: Light coral-red, anteriorly with four to six narrow blue bands not reaching ventral outline, the posterior ones growing narrower and fainter. A blue streak upwards and backwards from each orbit, the two uniting on occiput. A transverse interorbital bar, a continuation of which encircles the orbit anteriorly. Below orbit, a blue bar consisting of two portions, one running downwards and obliquely backwards, the other upwards and backwards. In the largest specimen a blue streak runs from occiput along profile to front of dorsal. The first blue bar runs from nape obliquely downwards and forwards, ending on opercle. The second vertically downwards from front of spinous dorsal, the third under middle of spinous dorsal, the remaining bars under soft dorsal. Fins unmarked.

Several small specimens, the largest 1 inch long, from Station 3001, 33 fathoms.

A single slightly larger example dredged by Mr. W. H. Dall, in about 35 fathoms, off Catalina Harbor, California.

32. *Microgobius cyclolepis* sp. nov.

Resembling *M. emblematicus*, differing in larger scales and different coloration.

Body somewhat elongate, compressed, the mouth very large, narrow, and oblique; maxillary produced beyond the rictus for a distance equaling two-thirds diameter of orbit, reaching vertical from posterior margin of pupil, $1\frac{3}{5}$ in head. Snout short, 5 in head. Eye larger, $3\frac{1}{4}$ in head. Interorbital width one-half orbit.

Teeth in upper jaw in two series, the outer enlarged and distant; in lower jaw apparently in a single series, similar to outer series of upper jaw, with two stronger canines anteriorly.

Inner edge of shoulder girdle without fleshy prominences.

Dorsal spines seven, none of them elongate, the membrane of last spine reaching base of first soft ray. Soft anal rays of moderate height, $1\frac{1}{2}$ in head, the tips of last rays reaching base of caudal, the fin similar to soft dorsal but lower. Caudal long, apparently rounded posteriorly, longer than head (mutilated in our specimen). Ventrals and pectorals reaching vent.

Scales cycloid, small, absent on belly, nape, and on sides in front of fourth dorsal spine. About forty-eight transverse rows of scales.

D. VII-16; A. 17.

Color in spirits: Light olive, the fins dusky; a conspicuous round black spot on shoulder, half size of eye, its posterior margin denser black.

A single specimen, about 2 inches long, from Station 3020, in 7 fathoms.

33. *Sebastichthys* [goodei* Eigenmann] sp. nov.

DIAGNOSIS: Scales small ctenoid. Cranial ridges and spines mostly obsolete. Lower jaw projecting. Anal spines graduated. Body slender. Sides with red.

Body very slender, with narrow caudal peduncle, sharp snout, and much projecting lower jaw; the latter well entering profile and furnished with symphyseal knob. Maxillary reaching slightly beyond middle of orbit, $2\frac{1}{3}$ in head. Eye moderate, slightly longer than snout, $3\frac{2}{3}$ in head. Preorbital narrow, its least width two-fifths pupil, with a minute spine or none. Nasal spine obsolete.

Interorbital space wide, flat, without conspicuous ridges. Preocular and supraocular spines obsolete. Occasionally a minute tympanic or occipital spine present, the top of head otherwise smooth. Interorbital width $4\frac{1}{4}$ in head. Preorbital region not prominent. All but the occipital ridges obsolete and scaled over.

Preopercular spines flat, sharp, all directed backward, the second and third equal, the others shorter. Opercular and suprascapular spines well developed.

Gill rakers long and slender, about twenty-five on anterior limb of arch, the longest half length of orbit.

Dorsal spines low and slender, the longest about $2\frac{2}{3}$ in head, the twelfth half height of thirteenth, the latter about half the height of soft rays, which are lower than the spines. Caudal forked for one-third its length.

Anal very small, the spines short but strong, graduated, the second stronger and slightly shorter than third, its length half orbit. Soft anal rays low, their height one-fourth head. Pectoral not reaching vent, $1\frac{2}{3}$ in head, projecting beyond tips of ventrals.

Head $2\frac{4}{5}$ in length; depth $3\frac{2}{3}$. Least depth of caudal peduncle less than diameter of orbit. D. XII, I, 14. A. III, 8. Lat. 1. 55 (pores); about ninety transverse series above lat. 1. L. 12 inches.

Scales rough-ctenoid, completely investing head and body, including maxillaries, mandible, and outer branchiostegal rays.

Color: Dusky-olivaceous above, silvery on sides and below, more or less flushed with red. Spinous dorsal somewhat dusky, vertical fins otherwise yellowish, without distinctive markings. Lining of mouth and gill cavity white. Peritoneum white, with small scattered black stellate spots, and more or less clouded with minute specks.

Three specimens from Station 2949, in 155 fathoms.

* In a paper by Dr. Carl H. Eigenmann, received as these sheets are passing through the press, this species is described under the name of *Sebastodes goodei*. The name proposed by Dr. Gilbert is therefore withdrawn. [ED.]

34. *Sebastichthys alutus* sp. nov.

DIAGNOSIS: Scales small, ctenoid; fifty tubes in lateral line. Crests evident but low; nasal, preocular, supraocular, postocular, tympanic and occipital spines present. Peritoneum black, buccal and gill cavities white. Second anal spine enlarged.

Specific description: Depth $3\frac{1}{5}$ in length; head $3\frac{2}{3}$. Caudal peduncle one-fourth the depth. Maxillary extending to middle of pupil, $2\frac{1}{3}$ in head. Teeth in very narrow bands in jaws, and on vomer and palatines. Preorbital very narrow, anteriorly lobate, but without distinct spines. Eye $3\frac{1}{4}$ in head. Interorbital space broad and flat, the supraocular ridges scarcely elevated; interorbital width $1\frac{1}{3}$ in orbit. Ridges all low, and with distinct but not prominent spines. Spines on preopercle all broadly triangular, directed backwards, those on horizontal limb larger than usual. Two spines on shoulder and two on opercle.

Gill rakers long and very slender, the longest one-half orbit; twenty-six on anterior limb.

Scales small, rough, those above lateral line much smaller than others, and irregularly disposed. Those on breast, snout, maxillary, and mandible smooth.

Fins low, the dorsal little elevated, and the notch shallow, the longest spine $2\frac{3}{4}$ in head, the twelfth $1\frac{3}{4}$ in longest. Soft rays also low. Caudal slightly emarginate, $1\frac{4}{5}$ in head. Second anal spine enlarged, much longer and stronger than third, as long as soft rays, but not nearly reaching their tips in reflexed fin, $2\frac{1}{3}$ in head. Ventrals reaching vent, and pectorals slightly beyond, the latter without procurent base or thickened rays.

D. XIII, 15; A. III, 8. Lat. l. 50 (tubes).

Color: Dusky above, with faint traces of darker blotches along back. A dark blotch on opercle, one on subopercle, and one on upper half of axil. Top of head, including membrane of premaxillary, dusky. Spinous dorsal with a distinct dark terminal band; the other fins, except pectorals, margined with blackish. Peritoneum black; mouth cavity white.

A single specimen, about 6 inches long, from Station 2946, in 150 fathoms.

35. *Sebastichthys rupestris* sp. nov.

DIAGNOSIS: Scales large, ctenoid. Cranial ridges well developed, sharp, the postocular and tympanic both present. Peritoneum black. Buccal and gill cavities white or slightly dusky. Second anal spine stronger than third.

Specific description: Depth $2\frac{5}{6}$ to 3 in length; head $2\frac{1}{2}$. Maxillary reaching beyond middle of pupil, $2\frac{1}{4}$ in head. Jaws equal, the tip of the lower scarcely projecting. Teeth in very narrow bands in jaws and on vomer and palatines. Preorbital very narrow, its least width less than one-fourth pupil, lobate and without spines. Eye $2\frac{4}{5}$ in head,

lower than snout or interorbital space. The latter narrow, concave, without ridges, the least width one-half the orbit.

Supraocular ridge short. Nasal, preocular, supraocular, postocular, tympanic, occipital, and nuchal spines present, the ridges of moderate height, but the spines, especially postocular and tympanic, strong. The preocular ridge but little conspicuous, the spine much smaller than in *S. sinensis* and *zacentrus*. Spines on shoulder little developed. Opercular spines rather weak. Preopercular spines small, the two upper directed backwards, the others downwards and backwards.

Dorsal fins not deeply notched, the longest spine 3 in head, the twelfth half its length. Soft dorsal not high. Caudal truncate. Second anal spine longer and stronger than third, as long as soft rays, but not reaching their tips when the fin is declined, $2\frac{2}{3}$ in head. Pectorals short, $1\frac{5}{6}$ to 2 in head, reaching beyond ventrals, but usually not to vent.

D. XIII, 13; A. III, 7. Pores in lateral line, thirty-one. About sixty vertical series counted above the lateral line.

Scales rough-ctenoid. Snout naked or nearly so. Scales on maxillary and mandible minute and smooth, little evident. Those on breast rough. Fins invested in a thick membrane covered with fine scales.

Color: As in *S. zacentrus*, but usually with two elongate black streaks below lateral line. A black blotch on middle of ventrals. A bar at base of pectorals and in axil.

Five specimens, the longest $5\frac{1}{2}$ inches long, from Station 2946, in 150 fathoms.

36. *Sebastichthys zacentrus* sp. nov.

DIAGNOSIS: Scales large; cranial ridges moderate, the postocular spine wanting, the preocular strong. Scales strongly ctenoid. Second anal spine very long, reaching tip of soft rays when the fin is reflexed. Peritoneum black, lining of buccal cavity white. Second anal spine enlarged.

Specific description: Body elongate, depth $3\frac{1}{3}$ in length. Caudal peduncle narrow, $3\frac{2}{3}$ in depth of body. Head $2\frac{4}{5}$ in length. Mouth moderate, maxillary reaching vertical from middle of pupil, $2\frac{1}{3}$ in head. Lower jaw slightly the longest, the tip with a small knob. Teeth in very narrow bands. Eye much longer than snout, 3 to $3\frac{1}{4}$ in head. Interorbital space narrow, somewhat concave, $1\frac{2}{3}$ in diameter of orbit. Preorbital extremely narrow, its least width two-sevenths pupil.

Ridges on head low, but sharp, the spines rather strong. Preocular ridge strong, triangular, ending in a strong outwardly-directed spine. Nasal, preocular, supraocular, tympanic, occipital, and sometimes nuchal spines present. Two spines on shoulder, two on opercle, and the usual five on preopercle, the latter directed backwards. Preorbital lobate, but without spines.

Gill-rakers long, very slender, one-half diameter of orbit, twenty-six present on anterior limb of outer arch.

Spinous dorsal low, with strong spines, the longest $2\frac{1}{3}$ to $2\frac{1}{2}$ in head. Notch between dorsals rather shallow, the shortest spine more than one-half the longest. Soft rays about equaling the spines. Caudal truncate or slightly emarginate, $1\frac{2}{3}$ in head. Second anal spine very long, usually longer and stronger than third, curved, $1\frac{1}{2}$ to $1\frac{4}{5}$ in head, reaching to or beyond tips of soft rays in declined fin. Ventrals reaching beyond vent, $1\frac{2}{3}$ in head. Pectorals reaching nearly to front of anal, $1\frac{1}{3}$ in head, the fin not procurent, the lower half with greatly thickened rays.

D. XIII, 14 or 15; A. III, 7 or 8. Tubes of lateral line about forty-two; seventy vertical series above lateral line.

Scales large, rough-ctenoid; those on maxillary, mandible, and breast smoother.

Color: Five vaguely defined black bars on back; one downward from nape and front of dorsal, two approximated under spinous dorsal, one under middle of soft dorsal, and one on caudal peduncle. Those under dorsal encroach more or less on the fin. All but the first are continued below lateral line on middle of sides, the third interrupted above lateral line. Two black streaks backwards from eye, the upper terminating in a conspicuous black blotch on opercle, the lower ending on subopercle. Caudal unmarked or with an obscure dusky median blotch. Other fins unmarked. A faint dusky axillary blotch.

Sides marked with some red in life.

Roof of mouth posteriorly dusky, buccal and branchial cavities otherwise white. Peritoneum jet black.

Three specimens $5\frac{1}{2}$ to $6\frac{1}{2}$ inches long, from Stations 2893 and 2946, in 145 and 150 fathoms.

37. *Sebastichthys saxicola* sp. nov.

DIAGNOSIS: Scales moderate. Pores in lateral line forty-five. Cranial ridges low, postocular wanting. Peritoneum black, buccal and gill cavities white. Second anal spine much enlarged. Gill-rakers long and slender. Mandibular tip strongly projecting.

Specific description: Depth, 3 to $3\frac{1}{4}$ in length; head, $2\frac{2}{3}$ to $2\frac{3}{5}$. D. XIII, 12 or 13; A. III, 7. Lat. l. 45 (pores). L., 12 inches.

Mouth large, maxillary reaching nearly to posterior margin of pupil, $2\frac{1}{4}$ in head. Mandible laterally included, the tip strongly projecting, with conspicuous symphyseal knob, which enters profile. Eye large, $2\frac{3}{4}$ to $3\frac{1}{4}$ in head, much longer than snout, or interorbital width. Interorbital space flat or slightly concave, without ridges, the supraocular ridges little elevated, the least width about equaling snout, 5 in head. Preorbital narrow, one-third pupil, with two strong triangular lobes with spinous tips.

Cranial ridges low but evident, the spines rather strong. Nasal, preocular, supraocular, tympanic, occipital and sometimes nuchal spines present. The preocular ridge prominent, the spine projecting above

eye. Preopercular spines directed backward, or the lowest slightly oblique. Gill-rakers long and slender, the longest two-fifths orbit. Highest dorsal spine $2\frac{1}{2}$ in head, the spines moderately strong, the membrane not deeply incised. Height of soft rays about equaling that of spines. Caudal emarginate. Second anal spine longer and stronger than third, and longer than soft rays, 2 to $2\frac{1}{3}$ in head. Ventrals usually not to vent. Pectorals nearly to front of anal. Scales rough-ctenoid on breast, maxillary, mandible, and snout.

Color: Olivaceous above, silvery below, overlaid below with light red; young with three or four brownish-black bars on sides, becoming faint in older specimens and sometimes also in young; in these a dusky blotch on occiput, one including front of dorsal, one under posterior rays of dorsal, one under soft dorsal, and one on back of tail. Dorsals sometimes with black spots, the spinous dorsal often with a submedian band of black, above which the incised membrane is white. Conspicuous olive-brown spots on caudal, usually confined to base and upper lobe of fin. Very abundant in deep water off the coast of southern California; taken at Stations 2893, 2907, 2949, 2959, and 2973, from 44 to 155 fathoms.

38. *Sebastichthys diploproa* sp. nov.

DIAGNOSIS: Scales large, ctenoid; cranial ridges rather weak but evident; postocular spines wanting; peritoneum black; buccal cavity white. Premaxillaries greatly produced on each side of median line. No dark markings. Gill-rakers long and slender. Second anal spine enlarged.

Specific description: Depth, $2\frac{3}{4}$ in length; head, $2\frac{1}{2}$. D. XIII, 12 or 13; A. III, 7. Lat. 1. 35 (tubes).

Maxillary reaching beyond middle of pupil, $2\frac{2}{5}$ in head. Premaxillary produced on each side of median line, forming two forwardly projecting dentigerous lobes, in the deep emargination between which fits the tip of mandible. Symphyseal knob small.

Eye large, 3 to $3\frac{1}{2}$ in head. Preorbital narrow, one-third pupil, with two strong diverging spines. Interorbital space rather wide, $1\frac{2}{3}$ in orbit, slightly concave, with a pair of low ridges or none. Occipital ridge prominent, sharp, the others low, but with strong spines; nasal, preocular, supraocular, tympanic, and occipital spines present. Preopercular spines strong, the second usually the longest, the third, fourth, and fifth directed downwards and backwards. Opercular spines longer than those on preopercle. Two small spines on shoulder.

Gill-rakers long and very slender, the longest half orbit.

Dorsal spines moderate, longer than soft rays, the longest $2\frac{1}{2}$ in head, the twelfth two-fifths its height. Caudal emarginate. Second anal spine longer and stronger than third, shorter than soft rays, $2\frac{1}{2}$ to 3 in head. Ventrals barely reaching vent; the pectorals slightly beyond, $1\frac{2}{3}$ in head, with broad base, the lower rays not thickened.

Scales large, minutely spinous and readily deciduous, very small and cycloid on maxillary, mandible, and breast.

Fin membranes thick and scaled.

Color: Uniform rose red above, bright silvery on sides and below, sparsely black-punctate, a faint dusky bar behind pectorals. Peritoneum jet-black. Spinous dorsal with dusky margins, the fins otherwise unmarked.

Many specimens, the largest described being 7 inches long, from Station 2935, in 124 fathoms.

39 *Sebastichthys aurora* sp. nov.

DIAGNOSIS: Scales, large, ctenoid. Cranial ridges and spines strong, the postocular, nuchal, and coronal spines present. Peritoneum, black. Mouth cavity, white. The second anal spine enlarged. Color, red.

Specific description: Depth, $2\frac{3}{4}$ in length; head, $2\frac{1}{2}$. Pores of lat. 1. 29. D. XIII, 13 or 14; A. III, 6. L. 12 inches.

Mouth large, the maxillary nearly reaching vertical from posterior margin of orbit, $2\frac{1}{4}$ in head, its width equaling diameter of pupil. Mandible, laterally as well as in front, largely shutting within the wide premaxillary band of teeth. Bands on vomer and palatines also wide. Eye large, $3\frac{1}{3}$ in head, much longer than snout or than interorbital space. Interorbital space narrow, somewhat concave, with a pair of strong ridges, its width half diameter of orbit.

Cranial ridges sharp, compressed, somewhat as in *S. rosaceus*, the preocular not specially prominent. Nasal, preocular, supraocular, postocular tympanic, occipital, nuchal, and usually coronal spines present. Preopercular spines regularly radiating, the upper four more nearly equal than usual. Preorbital wider, its least width two-fifths pupil, with two strong triangular spines, directed downwards and backwards. Gill-rakers slender, the longest little more than one-third of eye.

Dorsal spines strong, not high, the longest $2\frac{1}{2}$ in head, the twelfth about one-third its height. Soft rays lower than spines. Caudal slightly emarginate. Second anal spine very strong, much longer and stronger than third, and about equaling in length the soft rays, its length about $2\frac{1}{2}$ in head. Ventrals reaching to or slightly beyond vent. Pectorals to front of anal.

Scales very rough-ctenoid, those of lateral line enlarged, covering breast, branchiostegal rays, mandible, maxillary, and part of snout; everywhere rough. Fins enveloped in a more or less lax membrane, invested with fine ctenoid scales.

Color: Uniform red, light below. A narrow black streak along edge of spinous dorsal, the triangular incised portions of membrane above it white. A similar mark between second and third anal spines. Fins otherwise unmarked.

From stations 2948 and 2960, in 266 and 267 fathoms.

40. *Sebastichthys introniger* sp. nov.

DIAGNOSIS: Scales large. Cranial ridges strong but not high; tympanic, nuchal, and postocular spines present. Peritoneum jet-black, buccal and gill cavities mostly black. Scales very rough, and with numerous accessory scales. Lower jaw projecting, with prominent symphyseal knob. Second anal spine equaling third.

Specific description: Body deep, compressed, interorbital space wide, but little concave, the ridges low and nearly parallel, the spines conical and very strong.

Head $2\frac{1}{2}$ in length; depth $2\frac{1}{5}$. D. XIII, 13; A. III, 7. Lat. 1. 30 to 35 (pores), about fifty-five vertical series of scales. L. 13 inches.

Mouth large, somewhat oblique, maxillary nearly reaching vertical from posterior margin of pupil, $2\frac{1}{5}$ in head. The prominent tip of mandible fitting into emargination between premaxillaries. Bands of teeth narrow on jaws, vomer, and palatines. Eyes very large, $3\frac{1}{2}$ in head; interorbital width $5\frac{1}{3}$ in head.

Preorbital with a raised ridge in front of eye; anteriorly with two flattened triangular lobes, sometimes bearing minute spinous points. Supraorbital ridge short, flat, and low, ending over posterior border of pupil. Nasal spines low; preocular not prominent; supraocular, postocular, tympanic, occipital, and nuchal strong. Two upper preopercular spines appromixated, equal, directed backwards, the three lower downwards and backwards. Spines on shoulder and opercles strong. Gill-rakers slender, of moderate length, not close set, the longest $2\frac{1}{2}$ in diameter of eye.

Dorsal spines strong, low, $3\frac{1}{4}$ in length of head, the twelfth more than half the longest; soft rays higher, $2\frac{3}{4}$ in head. Caudal emarginate, $1\frac{4}{5}$ in head. Second anal spine equaling third in length, but little stronger, about $1\frac{1}{2}$ in soft rays. Pectorals reaching to or slightly beyond vent to beyond tips of ventrals.

Scales large, everywhere very strongly ctenoid, with numerous accessory scales, covering most of snout, maxillary mandible, branchiostegal rays, and gular membrane. Vertical fins with lax membranes, closely scaled. Lower pectoral rays not thickened.

Color: Red, with two faint wide dusky bars reaching to below middle of sides, one under middle of spinous dorsal, one under soft dorsal. A black blotch on opercle. A small black bar under upper two preopercular spines. Axil black. Lining membrane of mouth and gill cavity largely black. Peritoneum jet-black. Soft dorsal, caudal, anal, and ventrals with distinct blackish margins. Pectorals unmarked.

Two specimens from Station 2948, in 266 fathoms.

41. *Sebastichthys sinensis* sp. nov.

DIAGNOSIS: Scales moderate, tubes of lateral line forty to forty-five, almost everywhere cycloid, not regularly imbricated; cranial ridges moderately high, the spines well-developed; nasal, preocular, supraoc-

ular, tympanic, and occipital spines present; mandible partly scaled; peritoneum, buccal, and gill cavities black; anal spines short, graduated.

Specific Description: Body short and deep, heavy anteriorly, with slender caudal peduncle; mouth large, maxillary reaching beyond pupil, $2\frac{1}{5}$ in head, its greatest width less than one-third its greatest length; jaws about equal, the lower mostly included within the upper, but the tip fitting into a notch between intermaxillaries, and with a somewhat projecting symphyseal knob; teeth present on vomer and in a long slender patch on palatines; eye very large, $2\frac{3}{4}$ to 3 in head; snout $4\frac{2}{3}$ to 5 in head; interorbital space rather narrow, concave, with a pair of low ridges; its width 6 in head.

Nasal spines present, preocular spines strong, triangular, directed outwards; supraocular ridges low, but evident, diverging posteriorly, ending in strong spines; tympanic and occipital spines also strong; upper three preopercular spines equal in length, placed close, and usually nearly parallel, directed backwards. The lower two small, directed downwards and backwards. Two opercular, two suprascapular, and two or three strong preorbital spines present.

Gill-rakers slender, the longest one-fifth orbit, twenty-one on anterior limb of outer arch.

Spines rather high and strong, the dorsal moderately notched, the highest spine $2\frac{1}{3}$ in head, about equal to soft rays, the lowest nearly one-half its height; membranes not deeply incised; second anal spine longer and stronger than third or than any of dorsal spines and longer than anal rays; its length about $\frac{1}{2}$ head.

Caudal slightly lunate, one-half head; pectorals reaching slightly beyond vent, the lower rays not thickened, the fin $1\frac{1}{5}$ in head; ventral spine as long as soft rays, $2\frac{1}{4}$ in head.

Scales small, not regularly imbricated, smooth and cycloid, except those on occiput and a few along lateral line on posterior part of body; snout naked, maxillary and mandible only partly scaled: soft rays of all the fins covered with series of small scales.

Head $2\frac{1}{2}$ in length; depth 3 D. XIII, 12; A. III, 5 Lat. 1. (tubes) 40 to 45.

Color: Pale below, dusky above, blotched with reddish and black; a blackish blotch on opercle; fins dull reddish, irregularly marked with blackish, the caudal mostly red, sometimes with a blackish terminal bar; cavity of mouth and gill-chamber and peritoneum jet-black.

Two specimens, the largest 7 inches long, from Station 3015, in 145 fathoms.

42. *Scorpaena* (*Sebastoplus*) *sierra* sp. nov.

Body of moderate depth, the snout sharp, the caudal peduncle slender, wedge-shaped.

Head $2\frac{1}{5}$ in length; depth 3. D. XII-10; A. III, 5, Lat. 1. 25 (tubes). Least depth of caudal peduncle less than one-fifth head.

Mouth large, the lower jaw wholly included, the dentigerous portion of premaxillaries shutting outside of mandible, with a deep notch anteriorly, which receives tip of mandible. A strong symphyseal knob. Maxillary, in adults, about reaching vertical from posterior border of orbit, nearly half length of head. Teeth in broad bands on jaws, vomer, and palatines.

Interorbital space narrow, concave, with a pair of low ridges much diverging behind, its width $2\frac{1}{3}$ in orbit. Eye large, equaling snout, 4 in head.

Head very rough, the spines compressed, knife-like, disposed in six well-defined series; the upper contains the nasal, the conspicuously projecting preocular, the supraocular, postocular, tympanic, occipital, and nuchal spines. The paroccipital ridge contains a single spine immediately behind orbit, and one at its posterior extremity; the bridge across cheeks is very strong, its ridge continued forwards onto preorbital bone and containing four very strong spines. Margin of preorbital with two diverging spines. Upper spine of preopercle very strong, in line with suborbital ridge, with a smaller spine at base; three other preopercular spines below this, directed downwards and backwards, the lower nearly obsolete in adults. No pit on occiput or below front of eye. Gill-rakers short and broad, about as high as wide, the longest about one-half diameter of pupil; seven in number on anterior limb of arch.

Dorsal spines weak, very low, the longest equaling diameter of orbit, the eleventh half this length. Soft dorsal short and high, its longest ray $2\frac{1}{2}$ in head. Caudal truncate, its length equaling length of snout and eye. Anal spines not very strong, the second slightly longer and stronger than the third, its length equaling length of snout, $1\frac{1}{2}$ in soft rays. Ventrals not reaching vent. Pectorals with narrow non-procumbent base, their width about equaling eye.

Scales large, thin, everywhere ctenoid, covering breast, cheeks, opercles, top of head, and a part of snout; wanting on maxillaries and mandibles.

Head with simple slender filaments, usually one to each spine. Each scale of sides with a fringe of minute filaments around edge.

Color: Light red, with irregular dark-greenish olive markings on upper half of sides. A blotch of same color below eye, one above opercular spine, and a few rounded spots on soft dorsal, more numerous on caudal. Lower side of head white. Buccal and gill cavities and peritoneum bright white.

Four specimens, the longest ten inches in length, from Stations 2996 and 3011, in 112 and 71 fathoms.

43. *Icelinus cavifrons* sp. nov.

Body not slender; the depth $4\frac{1}{2}$ in length; the depth of caudal peduncle about one-third its length; head $2\frac{3}{4}$ to 3.

Mouth small; the maxillary reaching but little beyond front of pupil $2\frac{3}{4}$ to 3 in head.

Eyes large, equaling length of snout, $3\frac{1}{2}$ in head.

Interorbital space narrow, groove-like; its width half diameter of pupil; nasal spines very strong, more than half width of pupil, without filament; supraorbital ridge ending above posterior margin of orbit in a strong spine as large as that on nasal bone. By the side of this, just behind eye, is another equally strong. Behind these spines the outline is suddenly broken by a deep circular pit, as large as pupil, bounded laterally and posteriorly by the short occipital ridges. Occipital spines strong; supraorbital flap well developed. No other conspicuous filaments in our specimens.

Upper preopercular spines strong, two thirds diameter of orbit, with one process directed backwards and three to five upwards. The usual three spines below this. A spinous point at lower angle of subopercle, and a short spine on shoulder.

Dorsal series of scales rather short, longer than head, extending from opposite fifth dorsal spine to base of third to last ray of soft dorsal. This series usually becomes single for a short distance posteriorly, and contains about nineteen in a series. A few scattered spinous plates behind axil of pectorals.

The two anterior dorsal spines are filamentous in males; not elevated in females; in our specimens extending when elevated to middle of soft dorsal.

D. X-14 or 15; A. 12 or 13. Lat. l. 38. L. $3\frac{1}{2}$ inches.

Ground color varying with the surroundings from olivaceous to bright coral-red. A broad black bar below eye, and four across back; one under spinous dorsal, two under soft dorsal, and one across caudal peduncle. Belly white, the dark bars encroaching on region below lateral line. Males are darker than females, with black punctulations covering sides and below; the branchiostegal membranes, the lower two-thirds of pectorals, the ventrals and anal black. Spinous dorsal irregularly blotched or mottled with black. Soft dorsal, caudal, and terminal portion of pectorals (in females) with dark cross-bars.

Numerous specimens from Stations 2907 and 2945, in 44 and 30 fathoms.

KEY TO SPECIES OF ICELINUS.

- a. A pit-like depression on occiput; nasal, two postocular, and occipital spines, strongly developed; first two dorsal spines filamentous in the male. Postaxillary plates present. Dorsal series of plates scarcely reaching end of soft dorsalCAVIFRONS.
- aa. No pit-like depression on occiput.
 - b. First two dorsal spines filamentous, about equally produced. Dorsal series of plates much longer than head, reaching end of soft dorsal. Postaxillary plates present. Nasal filament present.....FILAMENTOSUS.
 - bb. First dorsal spine filamentous, the second little, if at all, produced. Dorsal series of plates usually shorter than head, not reaching middle of soft dorsal. No nasal filament. Postaxillary plates present.....TENUIS.

bbb. None of the dorsal spines filamentous. Postaxillary plates wanting. Dorsal series of plates more complete, extended posteriorly on back of caudal peduncle.

c. Nasal tentacle broad and palmate, with narrow stem-like base. Nasal, two postocular, and occipital spines present. Interocular space about half pupil. Supraocular filament usually fimbriate. Head $2\frac{1}{2}$ in length.

FIMBRIATUS.

cc. Nasal tentacle simple, slender. Eye very large; interocular space very narrow, about one-fourth pupil. Maxillary reaching posterior border of pupil. No postocular or occipital spines. Head $2\frac{1}{2}$ in length... OCULATUS.

ccc. No nasal tentacle. Head small, one-third length. Interocular space $2\frac{1}{2}$ in pupil. Dorsal series of plates usually interrupted under posterior rays of soft dorsal, then continued on back of caudal peduncle. No postocular spine; nasal and occipital spines present..... QUADRISERIATUS.

44. *Icelinus filamentosus* sp. nov.

Body shaped as in *I. quadriseriatus* but heavier, the depth $4\frac{3}{4}$ in length; caudal peduncle two-thirds diameter of orbit. Mouth small, maxillary not reaching vertical from middle of pupil, $2\frac{3}{4}$ in head. Teeth in broad bands on jaws, vomer, and palatines. Eye moderate, $3\frac{7}{8}$ in head. Interorbital space not narrow, grooved, its width more than half diameter of orbit. Preopercular spine strong, three-fourths diameter of orbit, with a short terminal point and three or four strong upwardly directed barbs, curved slightly forwards. Below this three short simple spines directed downwards, and downwards and forwards.

Nasal spines strong; occiput with a broadly rounded ridge, ending behind in a rather blunt point. No pit behind eyes. No other spines on head. Gill membranes broadly joined, free from isthmus.

A simple slender filament at base of nasal spine, a conspicuous one on tip of maxillary, two on occipital ridge, three on preopercular margin, an inconspicuous one near base of opercular flap. A large black supraocular flap, about as long as diameter of pupil.

Body armed essentially as in *quadriseriatus*; the upper series of plates double throughout, beginning under third or fourth dorsal spine, and terminating under last dorsal ray, twenty-eight or thirty in each series. Thirty-six to thirty-seven plates in lateral line, their posterior borders occasionally with a slender white filament. Axil of pectoral with from two to six half-imbedded spinous plates. Skin otherwise smooth.

Fins large, the spinous dorsal with the first two rays produced into long slender filaments, which reach beyond middle of soft dorsal, and are much longer than head. The membrane between these is not incised, and they are not separated from rest of fin. Dorsals not connected, the longest ray of soft dorsal nearly half head. Pectorals not long, $1\frac{1}{3}$ to $1\frac{1}{2}$ in head. Ventrals about one-fifth head.

Head $2\frac{6}{7}$ in length; depth $4\frac{1}{3}$ to $4\frac{1}{2}$. D, X-16 or 17; A. 14 or 15. L. 9 inches.

Color: Olivaceous above, white below; a distinct black blotch under spinous dorsal, one or two diffuse blotches under soft dorsal, and sev-

eral along lateral line. Below lateral line an irregular series of small pearly spots, most distinct anteriorly. A dark bar vertically crossing cheeks. Gill membranes dusky. Pectorals black at base and on lower rays, upper part white with two irregular cross-bars. Ventrals dusky. Anal white, margined with black. Caudal with a dusky cross-bar at base and tip, mesially white. Dorsals translucent, narrowly edged with black, and with narrow oblique, somewhat irregular, dusky cross-bars.

Several specimens from stations 2893 and 2959, in 145 and 55 fathoms.

45. *Icelinus tenuis* sp. nov.

Body slender, tapering into a very slender caudal peduncle, whose depth is less than one-third its length, and half diameter of orbit.

Depth of body $5\frac{1}{5}$ to $5\frac{1}{2}$ in length. Maxillary reaching slightly beyond middle of orbit, $2\frac{1}{5}$ in head. Bands of teeth narrower than usual, present on jaws, vomer, and palatines. Interorbital space narrow, half diameter of pupil, slightly concave posteriorly, the ridges converging anteriorly and meeting above front of pupil. Eye large, longer than snout, $3\frac{1}{4}$ to $3\frac{2}{5}$ in head. Upper preopercular spine smaller, about as long as pupil, with a short terminal process, and two or three upwardly directed ones. Below this a simple spine directed backwards, and two directed downwards and forwards. Nasal spines strong. Two strong spines behind upper edge of orbit, and a single sharp one at end of occipital ridge. Occipital region gently concave; no pit behind eyes. No spine on opercle or suborbital, and no distinct spine on shoulder.

A simple black flap on upper rim of orbit posteriorly. No other flaps on head, and usually none on plates of lateral line.

Plates of lateral line as in related species, forty-one in number. Dorsal series of plates arranged in a double row as usual, but very short, beginning under fifth dorsal spine and ending under first third of soft dorsal, its length varying from slightly longer than head to two-thirds its length, double throughout. Sides immediately behind axil of pectorals with about fifteen plates, similar to those of lateral line, but smaller, scattered or showing a tendency to regular arrangement. First ray of spinous dorsal very slender, filamentous, varying in length, in adults reaching end of soft dorsal. The second spine is sometimes slightly produced, but is never long. The two dorsals are entirely disconnected, the height of soft dorsal half or three-fifths length of head.

Pectorals long in males, reaching much beyond front of anal, as long as head. Ventrals nearly three-fourths orbit.

Head $3\frac{1}{4}$ to $3\frac{2}{5}$ in length; depth, $5\frac{1}{5}$ to $5\frac{1}{2}$. D. X-17 to 19; A. 15 to 17. L. $5\frac{1}{2}$ inches.

Color: Light olivaceous above, white below, the back with four black cross-bars, the first under spinous dorsal, the second and third under anterior and posterior parts of soft dorsal, the fourth at base of caudal. Back and sides, including head, with pearly dots and lines; those on upper parts frequently curved and margined with dark. Spinous dorsal with a small dark blotch posteriorly, and some dusky mark-

ings. Soft dorsal translucent, with broad oblique dusky bars. Caudal with the dusky basal bar continued on upper and lower rays at base. The basal half of fin translucent, its terminal portion with two or three blackish cross bars. Anal black-edged in males. Ventrals black in males. Base and lower half of pectorals largely black in males, the terminal portion with pearly and dusky bars. Branchiostegal membranes black in males. A broad black bar below eye. Numerous specimens from stations 2893, 2946, 2959, 2977, and 2983, in from 45 to 150 fathoms.

46. *Icelinus fimbriatus* sp. nov.

Shape much as in *I. quadriseriatus*, the depth $4\frac{3}{4}$ in length. Depth of caudal peduncle two-thirds of orbit.

Mouth larger, the maxillary reaching beyond middle of pupil, $2\frac{1}{2}$ to $2\frac{1}{2}$ in head. Teeth as usual. Nasal spines strong. Interorbital space narrow, grooved, half length of pupil. Eye $3\frac{5}{8}$ to $4\frac{1}{2}$ in head.

Preopercular spine very heavy, slightly more than half orbit, with a terminal tooth, and three upwardly directed processes. Two blunt spines behind eye, and another at end of occipital ridge. Three preopercular spines below the main one. No distinct spines on opercle or shoulder. A spine at lower angle of subopercle.

Conspicuous palmate tentacles on nasal spines and above and behind eye. Besides these, a number of simple or divided filaments on eyeball, occiput, preorbital, maxillary, preopercle, and along lateral line, the latter mostly in groups of three to five.

Plates on sides as in related species, thirty-six to thirty-eight along lateral line, thirty-two in upper dorsal series. The dorsal series become single behind dorsal fin, double elsewhere, beginning between third and fourth dorsal spines. No plates in axil.

None of the dorsal spines filamentous, the middle ones the longest, the soft rays still higher. Dorsal fins wholly separate.

Ventrals small, about two-thirds diameter of orbit. Pectorals short, about half head.

Head $2\frac{1}{2}$ to $2\frac{2}{3}$ in length. D. X-15 or 16; A. 12. L. $5\frac{1}{2}$ inches.

Color: Olivaceous above, with about four irregular black bars, white below; middle of sides black, with larger or smaller roundish white spots. Lips black, crossed by narrow white streaks. Branchiostegal membranes blackish. Ventrals white, other fins all crossed with oblique or vertical black bars. Spinous dorsal largely black anteriorly and at tips of posterior spines. Pectorals largely black on basal portion of lower rays. Barbels white, except the supraocular, which are black.

Specimens taken at stations 2893 and 2975, in 145 and 36 fathoms.

47. *Icelinus oculatus* sp. nov.

Body elongate, depth $5\frac{1}{4}$ in length, tapering rapidly backwards to the very slender caudal peduncle, whose least depth is $2\frac{1}{2}$ in its length. Lower profile straight; head sharp anteriorly, the occipital ridges blunt,

the included space gently concave, not pit-like. Interorbital space very narrow, slightly concave posteriorly, with a median ridge in front, very strongly expanding over front of eye. Interorbital width two-sevenths of pupil. Eyes very large, equaling snout, $3\frac{3}{5}$ in head. Mouth large, extending beyond vertical from pupil, $2\frac{1}{4}$ in head. Teeth in rather narrow bands in jaws and on vomer and palatines.

Preopercular spine rather small, in the single specimen known, bifid at tip and with two strong antler-like processes directed upwards. The number of these latter varies in all known species, and is probably normally greater than two in this species. Below this, a weak spinous projection directed backwards, and two stronger ones downwards and forwards. A spinous point at lower angle of subopercle, none on occiput, shoulder, or opercle. Branchiostegal membranes and gill rakers as usual.

Head long, $2\frac{3}{5}$ in length. D. X-16; A. 14. Lat. l. 39. L. $5\frac{1}{2}$ inches.

Armature of sides as usual, the dorsal series of plates unusually well developed, extending from opposite second dorsal spine to beyond second dorsal, where the series becomes single, those of the two sides closely approximated. No scattered plates behind pectorals. An elongate, simple, supraorbital flap, a filament in connection with nasal spine, two on occipital ridge, and one on maxillary; a few filaments on plates of lateral line. None of the dorsal spines elevated; pectorals reaching slightly beyond origin of anal.

Color: As in *I. tenuis*, but the light spots on upper parts of body not elongate, and not dark margined. No conspicuous dark bar below orbit. The anal fin is translucent in our specimen, a female.

A single specimen from Station 2935, in 124 fathoms.

Radulinus gen. nov. (*Cottidæ*).

Spinous dorsal short, the soft dorsal and anal very long. Branchiostegal membranes broadly united, posteriorly free from isthmus. No slit behind last gill. Broad bands of cardiform teeth on jaws, a single series on vomer, none on palatines. Preopercle with two short, simple spines. Ventrals, I, 3. Body very slender. Sides armed with a series of large, keeled, spinous plates along lateral line. Similar plates on head.

Type, *Radulinus asprellus* sp. nov.

48. Radulinus asprellus sp. nov.

Body very elongate, the greatest depth at occiput, $8\frac{1}{2}$ to $9\frac{1}{2}$ in length, $1\frac{1}{3}$ in width of head. Body subquadrate in cross-section, the upper angles being formed by the keel of lateral plates, tapering gently to the very slender flat caudal peduncle, everywhere as wide as, or wider than, deep. Mouth small, reaching front of pupil, $2\frac{3}{4}$ in head. Eyes large, closely approximated, the interorbital space very narrow, not grooved, less than one-fourth pupil; orbit $2\frac{3}{5}$ to $2\frac{3}{4}$ in head.

Preopercular spines two only, short, simple, the lower directed backwards, the upper backwards and upwards. Nasal spines long and strong, a depression behind them; head otherwise smooth. Occiput not ridged.

A series of large, keeled, spinous plates along lateral line, running high on sides; their free edge is turned obliquely upwards, and armed with from one to several long spines mesially, and shorter ones above and below; a row of minute spinous plates along upper edge of series anteriorly. The series along lateral line is continued forwards on top of head, meeting its fellow in a V shaped patch filling posterior portion of interorbital space. Similar plates on snout and opercle, the head and body otherwise naked. In cross-section, the plates mark an abrupt angle, the back being flat, the sides vertical.

Head $4\frac{1}{4}$ to $4\frac{1}{2}$ in length; depth, $8\frac{1}{2}$ to $9\frac{1}{2}$; D. VIII to X-21 or 22; A. 23 or 24. Lat 1, 38 to 40. Length, 5 to 6 inches.

Dorsal spines slender, the two fins well separated. Rays of soft dorsal and anal very slender, rather long. Caudal truncate or rounded, two-thirds head. Pectorals with eighteen or nineteen rays, the lower much shortened, but scarcely thickened, as long as head. Ventrals long and slender, with one spine and three well developed rays, reaching to or nearly to vent. Anal papilla very long in males, more than one-third head.

Color: Light olivaceous, with a series of elongate, narrow, brown streaks along middle of sides, the latter also finely punctate with black. A dark streak in front of eye. Fins translucent, the dorsals, pectorals, and caudal, with some black spotting, which shows a tendency to form bars. Anal and ventrals white.

Numerous specimens, from stations 3046, 3057, 3058, and 3059, in depths of from 43 to 77 fathoms.

Bathyagonus gen. nov. (*Agonidæ*).

Spinous dorsal developed. Lower jaw the longer. Plates of body spinous. Gill membranes united to the isthmus, not forming a fold across it. Teeth well developed on jaws, vomer, and palatines. Pectorals not notched, the upper rays the longest, the lower becoming regularly shortened. Bones of head thin and yielding, the system of mucous canals very strongly developed.

Type, *Bathyagonus nigripinnis* sp. nov.

49. Bathyagonus nigripinnis sp. nov.

Body exceedingly slender, depressed, everywhere as wide as or wider than deep. Snout wide, flattened, transversely depressed in front of eyes, its width more than twice its greatest depth.

Eyes large, the orbit $2\frac{3}{5}$ in head. Interorbital space $3\frac{1}{2}$ in orbit, grooved, with a pair of ridges.

Mouth somewhat oblique, the lower jaw distinctly projecting, the maxillary scarcely reaching front of orbit, equaling length of snout, $3\frac{1}{2}$ in head. The snout shows a narrow bony ridge, but is otherwise covered with thin membrane.

Teeth not strongly developed, in narrow bands in jaws, and on vomer and palatines.

Nasal spines small; a movable plate on tip of snout, bearing three small, backwardly-diverging spines. One supraocular spine, two on occipital ridge, two on paroccipital ridge, two on preopercular margin, and one or two on bony bridge across cheeks. Two or three bony plates below this bridge, each with a central spine. The bony ridge, as well as mandible and horizontal limb of preoperculum, is deeply excavated below for mucous canals, and contains very large mucous pores. Ridges on head usually finely serrulate. Branchiostegal membranes very broadly joined to isthmus, without fold. Usually a single bony plate on the membranes mesially. A single minute black barbel on tip of maxillary; none others on head.

Plates arranged as usual, all spinous except medium series on caudal peduncle below. Seven plates in front of dorsal, nine under spinous dorsal, four between dorsals, seven under soft dorsal, eighteen on back of tail. Lat. l. 44.

Plates on breast subangular, regularly arranged, the plates of the three medium series each with a crest and a spine. Breast with twenty-five to thirty plates. Two or three plates on membrane behind symphysis of lower jaw.

Head $4\frac{4}{5}$ in length; depth $2\frac{3}{5}$ in head. Caudal peduncle $2\frac{1}{2}$ in length. D. VII-6 or 7. A. 7. V. I. 2. L. 6 inches.

Distance of dorsal from nape equals length of head behind pupil. Distance between dorsals equals diameter of orbit. Origin of anal under interspace between dorsals. Caudal posteriorly rounded, the median rays longest, slightly less than half head. Pectorals not notched, the uppermost rays longest, regularly shortened below. The rays all simple, none of them thickened, the longest $1\frac{2}{5}$ in head. Ventrals very short, two-thirds diameter of orbit.

Color: Light above, blue-black on lower side of head; breast and belly dusky below posteriorly. All fins intense blue-back.

Many specimens from station 3073, in 477 fathoms.

***Xenochirus* gen nov. (*Agonidae*).**

Spinous dorsal present. Jaws equal, or the upper the longest. Plates of body spinous. Gill membranes united to the isthmus, the posterior edge sometimes forming a very narrow free fold across the throat. Teeth well developed on jaws, vomer, and palatines. Pectorals divided by a deep notch into two portions, the lower composed of greatly thickened rays which are simple and frequently longer than those of upper lobe. A series of small spines on eyeball above pupil.

Type, *Xenochirus triacanthus* sp. nov.

50. *Xenochirus triacanthus* sp. nov.

Characterized by its long snout, bearing three spines, its small eyes, the gill membranes without free fold, the cheeks with plates below the bony bridge.

Head $4\frac{5}{6}$ to 5 in length; depth slightly less than half head. Eye 3 in head. Maxillary $3\frac{3}{4}$ in head. D. V or VI-6 or 7; A. 6, P. 13, V. 1, 2. Lat. l. 41. Length 7 inches.

Interorbital space narrow, ridgeless, channeled, $3\frac{1}{2}$ in orbit. Snout long, less depressed than usual behind the nasal spines, $3\frac{1}{2}$ in head, its length equaling its greatest width. Mouth horizontal, the lower jaw but slightly included, the maxillary not reaching vertical from front of orbit, $3\frac{3}{4}$ in head. Teeth in broad bands in jaws and on vomer and palatines. Two nasal and one terminal spine on snout, well developed, the widely triangular base of the latter only slightly overhanging premaxillaries. Three to five spines on eyeball. A supraocular spine present, two on occipital ridge, one on paroccipital ridge, two on preopercular margin, the lower broadly triangular, but with spine-like tip. One spine on bridge across cheeks. Three plates, with centrally radiating striæ, but without spines, below bony bridge across cheeks.

Gill membranes broadly joined to isthmus, without free fold. Five or six small bony plates mesially on branchiostegal membranes.

Two or three long thick barbels at tip of maxillary, and three smaller pairs on lower side of mandible.

Distance from front of dorsal to nape equals length of head behind front of eye. Distance between dorsals, $1\frac{1}{2}$ in orbit. Caudal truncate, about half head. Pectorals deeply notched, the four lower rays thickened, the two upper of these elongate, $1\frac{1}{4}$ in head. Ventrals short, $2\frac{1}{2}$ in head.

Plates spinous, and arranged as usual; seven before dorsal, seven under spinous dorsal, two between dorsals, seven under soft dorsal, sixteen or seventeen on back of tail. Lat. l. 41. Plates covering breast subangular, the center little elevated, not spinous, weakly striate.

Color: Olivaceous, with traces of darker cross-bars on back. Fins white or somewhat dusky, unmarked, the dorsal not black-margined.

From stations 2893, 2973, and 3059, in 145, 68, and 77 fathoms.

51. *Xenochirus pentacanthus* sp. nov.

Head $4\frac{3}{4}$ in length; depth $2\frac{1}{2}$ in head. D. VII-7; A. 8. V. I, 2; P. 15. Length, $6\frac{1}{2}$ inches.

No decided pit on nape or occiput, the region behind eyes and behind occiput slightly depressed and concave. Eye large, longer than snout, 3 in head. Interorbital area narrow, grooved, with two low ridges, its width one-fourth diameter of orbit. Snout rather long, $3\frac{1}{2}$ in head, flat, the area behind nasal spines much depressed, concave.

Mouth horizontal, the jaws equal, the maxillary scarcely reaching

vertical from front of eye, $3\frac{3}{5}$ in head. Teeth small, in broad bands on jaws, vomer, and palatines. Gill membranes broadly united across throat, joined mesially to isthmus, and without free fold. Anterior nostril with a short tube and without flap.

Nasal spines strongly developed. In front, on tip of snout, a small broadly-triangular movable plate, bearing three spines diverging backwards, much smaller than nasal spines, and not overhanging premaxillary. A pair of spines on sides of snout behind nostrils, two posteriorly on suborbital process, one or two on a line with latter on preopercular margin. A large spine at upper posterior margin of orbit, two on occipital ridge, and four on a lateral ridge behind eye, the latter including spine on shoulder. A few other spines on head. A row of usually four backward-directed spines on eyeball above pupil. Below the bony bridge across cheeks a row of three tubercular plates, each, or the two last, bearing a backward-directed spine.

Two long barbels on end of maxillary, and one below on each side of mandible.

Distance of front of dorsal from nape equals length of snout and eye. Distance between dorsals equals diameter of orbit. Front of anal under interspace between dorsals. Pectorals deeply divided, the lower four or five rays greatly thickened, in adults longer than the upper rays, separated from them by a notch. Ventrals one-third head. Pectorals $1\frac{1}{3}$ in head. Caudal truncate, about half head.

Plates covering breast rather large, subangular, not spinous, each with lines radiating from the elevated center. Plates on sides strongly spinous, the series arranged as usual, with a dorsal and a ventral pair becoming single on caudal peduncle, and two lateral pairs. Eight plates in front of dorsal fin, nine along basis of spinous dorsal, three between dorsals, eight under soft dorsal, and sixteen on caudal peduncle. Lat. line 43.

Color : Dusky, without conspicuous markings, with four or five faint dusky cross bars on back; a blackish blotch in axil. Caudal black, narrowly white-edged. Dorsals dusky, darker towards tips, the soft dorsal narrowly white-edged. Pectorals dusky. Ventrals white.

Several specimens from station 3076, in 178 fathoms.

52. *Xenochirus latifrons* sp. nov.

Differing from other species in the very short snout, the large eye, the three spines on snout, and in the branchiostegal membranes, which are free posteriorly.

Head, $4\frac{2}{5}$ in length; depth half head. Eye $2\frac{1}{2}$ to $2\frac{3}{4}$ in head. D. VI or VII, 7; A. 7 or 8, V. I, 2, P. 14 or 15. L. 6 inches.

Interorbital space narrow, deeply channeled, without ridges, $3\frac{2}{5}$ in orbit. Snout short, $3\frac{1}{4}$ to 4 in head, broadly triangular, with a notable depression between nasal spines and front of eyes. Mouth slightly oblique, the lower jaw a little included, the maxillary reaching vertical

between front of eye and pupil, $3\frac{1}{5}$ in head. Teeth in broad bands on jaws, vomer, and palatines.

Nasal spine very strong. A strong spine of nearly equal size on a movable triangular plate at tip of snout, slightly overhanging front of premaxillaries. Supraocular and occipital spines strong, single; a small spine terminating the paroccipital ridge. A slight groove behind eyes and one on nape. A spine on preopercular margin and one on bridge across cheeks. No plates on cheeks below this. No other spines on head.

Branchiostegal membranes broadly joined, united to isthmus, forming a narrow free margin posteriorly nearly as wide as interorbital space.

Eye with a series of 3 to 5 backward-directed spines, bounding pupil above. Opercle scarcely striate.

A single long barbel at tip of maxillary. Two pairs of shorter filaments on lower surface of mandible.

Distance from front of dorsal to nape equals length of snout and eye. Distance between dorsals about $1\frac{1}{2}$ in orbit. Front of anal under middle of interspace between dorsals. Pectorals partially divided, the lower four or five rays separated by a notch from rest of fin, thickened and elongate, $1\frac{1}{5}$ in head. Ventrals $2\frac{1}{3}$ in head. Caudal truncate, half length of head.

Plates spinous, arranged as usual. Seven plates before dorsal, seven under spinous dorsal, two between dorsals, seven under soft dorsal, fourteen on back of tail. Lat. 1. 39. Plates on breast oval, with raised center and striate, without spines.

Color: Dusky olive, light below, back with five or six faint darker; cross-bars. Axillary region blackish. Soft dorsal and caudal with the rays black. Spinous dorsal with a conspicuous jet-black margin. Pectorals somewhat dusky above. Ventrals white.

Abundant; taken at stations 2898, 2935, 2948, 2972, 2973, and 3059, in 61 to 158 fathoms.

53. *Paraliparis rosaceus* sp. nov.

Body slender, covered with lax skin, which invests also the fins. Head small, $5\frac{2}{3}$ in length; depth, $4\frac{3}{4}$. Mouth transverse, nearly horizontal, the maxillary scarcely vertical from front of pupil, equaling length of snout, $3\frac{1}{4}$ in head; eye half interorbital width, 5 in head.

Teeth in lower jaw pointed, in a single close-set series, their even tips forming an almost uniform cutting edge. Teeth in upper jaw apparently paved, the jaw presenting a smooth, rounded surface, on which the teeth are little evident, but occasionally present sharp projecting points. Lower jaw included.

A series of conspicuous mucous pores on snout, mandible, and on preopercle. Gill opening a narrow slit above base of pectorals.

Pectoral fin divided into two wholly distinct lobes not connected by

intervening rays, a space without rays present, equaling diameter of pupil. The lower lobe consists of four rays, the longest three-fifths head, inserted under preopercular margin. The main portion of the fin consists of about fifteen rays and is but slightly longer than the lower lobe; dorsal beginning behind middle of pectorals, its distance from tip of snout $4\frac{1}{6}$ in length; distance of origin of anal from tip of snout equaling one-third standard length.

Vent under base of upper pectoral rays, but wholly behind base of lower lobe of pectorals, its distance from tip of snout equaling length of head and equaling also its distance from origin of anal. No trace of ventral disk or fins.

D. 58; A. 53.

Color: Light rose-red, the fins and head largely jet black. Abdomen behind vent blackish. Peritoneum and lining membranes of mouth and gill-cavity jet black.

A single specimen, $5\frac{1}{2}$ inches long, from station 2919, in 984 fathoms.

54. *Gobiesox pinniger* sp. nov.

Head $2\frac{3}{5}$ to $2\frac{2}{3}$ in length; width of body $4\frac{1}{5}$; of head, 3 in length. D. 16 or 17; A. 8 or 9.

Interorbital width $3\frac{1}{4}$ in head; eye half interorbital width; width of mouth $1\frac{3}{5}$ to $1\frac{3}{4}$ in head. L. $2\frac{1}{4}$ inches.

Teeth in upper jaw conic, acute, in several series, the anterior row in front enlarged, unequal. In lower jaw the teeth mesially in two distinct series, those in middle of anterior row narrow entire incisors, those laterally conic, canine-like.

No evident opercular spine.

Disk about as broad as long, its length about that of head.

Front of dorsal varying in position, about midway between snout and base of caudal, its length about half that of body. Vent nearly equidistant between disk and front of anal, the base of latter $3\frac{1}{2}$ to $3\frac{3}{4}$ in body. Caudal $1\frac{1}{2}$ to $1\frac{3}{4}$ in head. Pectorals about one-third of head, with a distinct fold at base.

Color variable. Anteriorly usually with reticulating dark lines surrounding yellowish spots. A narrow dark streak forward, one downward, and one backward from orbit. Below dorsal fin about six dark bars running obliquely downward and backward, these sometimes in greater number, frequently more or less irregular and interconnected, often divided by vertical streaks or series of dots. Body sometimes light in spirits, without distinctive markings. Vertical fins usually dusky, narrowly margined with white, sometimes lighter with dark margins.

Abundant in the Gulf of California. Specimens taken at Puerto Refugio, Angel Island, San Luis Gonzales Bay, and La Paz.

55. *Gobiesox funebris* sp. nov.

Body rather slender, its width 5 in length. Width of head $3\frac{1}{2}$ to nearly 4.

Head $2\frac{3}{4}$ to 3 in length; depth half head. D. 9; A. 6 or 7. L. $2\frac{1}{2}$ inches.

Teeth in upper jaw conical, in several series, unequal but without canines. In lower jaw mesially in two series, the outer of narrow entire incisors, truncate or rounded, without lateral canines. Interorbital space wide, 3 in head, the eye small, $\frac{2}{3}$ interorbital width. Mouth very wide, half or more than half length of head. Ventral disk wider than long, its length $1\frac{1}{2}$ to $1\frac{2}{3}$ in head. No evident opercular spine.

Distance from front of dorsal to base of caudal $2\frac{3}{5}$ to 3 in length anterior to dorsal. Distance from vent to front of anal fin $1\frac{1}{2}$ to $1\frac{2}{3}$ in its distance to disk. Base of dorsal from $1\frac{1}{2}$ to $1\frac{1}{4}$ in head; base of anal about half head. Caudal rounded, $1\frac{3}{5}$ to $1\frac{3}{4}$ in head; pectorals $3\frac{1}{4}$ in head.

Color: Varying from dark olive-brown to black, everywhere covered with fine yellowish vermiculations, usually arranged to form narrow lighter bars on the sides. Three or four obscure dark streaks radiating from the eye. Blackish below, the fins varying from blackish to straw-color.

Abundant at Puerto Refugio (Angel Island) and La Paz.

56. *Gobiesox humeralis* sp. nov.

Body of moderate width, the head not evenly rounded anteriorly, becoming contracted opposite eyes, the snout forming a quadrate projection beyond the profile, as seen from above. Head wider than body. Width of body $4\frac{1}{4}$ in length, of head $3\frac{3}{4}$.

Teeth in a single series in each jaw, the anterior narrow incisors, trilobate at tip, the two posterior teeth on each side strong conical canines, somewhat recurved. About twelve incisors in the upper jaw.

Interorbital space very wide, about equaling width of mouth, $2\frac{1}{3}$ to $2\frac{1}{2}$ in length of head. Eye very small, 3 in interorbital space. Head 3 to $3\frac{1}{2}$ in length.

Ventral disk as wide as long, its length $1\frac{1}{4}$ in head. No evident opercular spine. Distance from front of dorsal to base of caudal 3 in length anterior to dorsal. Base of dorsal $1\frac{2}{3}$ in head, of anal half head. D. 8 or 9; A. 7.

Distance from vent to front of anal half its distance from disk. Caudal broadly rounded, $1\frac{3}{4}$ in head. Pectoral one-third head, without distinct fold of skin across it.

Ground-color, dark olive-brownish, crossed by many carmine-red bars, these somewhat broken anteriorly and above, to form reticulating lines, posteriorly and on lower part of sides more regular and running obliquely downwards and backwards. A conspicuous round humeral

spot, larger than eye, in life black with golden green reflections. Numerous streaks from eye backwards across cheeks and opercles.

Abundant at Puerto Refugio (Angel Island). A few specimens seen at La Paz.

57. *Gobiesox eigenmanni* sp. nov.

D. 4; A. 5. Head $3\frac{2}{3}$ in length; depth about half head.

Body very slender and narrow, the width of head $4\frac{4}{5}$ in length, width of body 6.

Mouth wide, the distance between its angles half length of head, the maxillary scarcely reaching vertical from front of orbit. Interorbital space wide, about half head. Eyes very small, about 3 in interorbital width.

Teeth in upper jaw conic, acute, in several series, the anterior in upper jaw enlarged. Teeth in lower jaw also in several series, those of front row narrow incisors, entire, with rounded or truncate edges.

Disk very small and narrow, its width about two-thirds its length, the latter $1\frac{2}{3}$ in length of head.

Fins all small, the base of dorsal two-fifths length of head, less than free portion of caudal peduncle. Distance from origin of dorsal to base of caudal $3\frac{1}{3}$ in length before dorsal. Distance from vent to front of anal fin $1\frac{3}{5}$ in its distance from disk. Caudal broadly rounded, its length $1\frac{4}{5}$ in head. Pectoral somewhat pointed, about half head.

Coracoid plate small, about half height of pectoral and less than half its length.

Color: Uniform light olive-green, without distinctive markings.

A single specimen, about 1 inch long, was taken at Point Loma, near San Diego, California. Other specimens were taken some years since at San Cristobal Bay by Mr. C. H. Townsend, and are referred to under the name of *G. rhessodon* in the Proceedings U. S. National Museum, volume 7, page 553.

58. *Gobiesox papillifer* sp. nov.

D. 13; A. 9. Head $2\frac{3}{5}$ in length; width of body $3\frac{2}{3}$; width of head $2\frac{4}{5}$.

Width of mouth $1\frac{4}{5}$ in head; interorbital width 3. Eye half interorbital width.

Teeth in upper jaw conic, acute, very small, in two or more series, two of them slightly enlarged, canine-like. Teeth in lower jaw in two series, the outer anteriorly, narrow entire incisors, with rounded tips, becoming conical laterally.

Opercular spine sharp, evident, though not projecting through the integument.

Lips and lower side of head anteriorly with fleshy papillæ.

Disk about as broad as long, its length $1\frac{1}{5}$ in head.

Distance from front of dorsal to base of caudal $1\frac{1}{2}$ in its distance from tip of snout. Vent exceptional in position, immediately in front of anal fin. Base of anal $1\frac{3}{4}$ in head. Caudal rather acute, $1\frac{2}{3}$ in head. Pectorals $2\frac{2}{3}$ in head, a distinct fleshy fold at base.

In spirits, uniform dark olivaceous, lower side of head and disk light. Pectorals dusky. Vertical fins with a black bar at base, then a white bar, followed by a wide, dusky area, and narrowly margined with white. Caudal with all these marks except the black bar, having the posterior outlines curved, following margin of fin.

One specimen, $1\frac{1}{2}$ inches long, from Magdalena Bay, Lower California.

59. *Bathymaster hypoplectus* sp. nov.

Differing from both *B. signatus* and *B. jordani* in the broadly united gill membranes, and from *signatus* in the scaly cheeks, the smaller scales, etc.

Head $4\frac{2}{3}$ in length; depth 7. D. 46; A. 33. Length about 8 inches.

Head and body compressed elongate, the anterior profile of head compressed, declivous. Mouth somewhat oblique, at lower side of snout, small, the maxillary reaching vertical from middle of pupil, $3\frac{1}{6}$ in head. Snout very slightly shorter than orbit, $4\frac{1}{3}$ in head; diameter of orbit 4 in head. Teeth well developed, in broad bands on jaws, vomer, and palatines, the vomer and palatine patches nearly continuous.

Branchiostegal membranes broadly united, free from isthmus, forming a fold whose depth exceeds half diameter of orbit. Margin of preopercle adnate behind, slightly free below, furnished with a series of six conspicuous mucous pores. Head without spines, ridges, or filaments. Inner margin of shoulder girdle conspicuously notched above and below, but without hook. Gill rakers tubercular, few in number. A well-marked slit behind last gill.

Distance from nape to front of dorsal fin equals its distance from posterior border of eye. Anterior ten or twelve dorsal rays simple and apparently not articulated, but flexible and not spine-like. Distance from front of anal to base of ventrals $2\frac{1}{3}$ in its distance from base of caudal. All but first third of dorsal rays, and all of anal rays forked at tip; dorsal not high, the longest rays half head; highest anal ray equals snout and half eye. Last dorsal and anal rays entirely disconnected from caudal, leaving a free space on caudal peduncle one-half diameter of orbit.

Ventrals 1, 5, in advance of base of pectorals, narrowly triangular, the inner rays longest. Pectorals with curved base running backwards and downwards, the rays all branched, eighteen in number; the width of base of fin $3\frac{1}{4}$ in head, the longest ray $1\frac{1}{3}$ in head. Caudal rounded, two-thirds length of head.

Body covered with small, partially embedded, cycloid scales, including antedorsal region, belly, breast, and area in front of base of pec-

torals. Cheeks covered with similar but smaller scales, the opercles and rest of head naked. Lateral line running high, parallel with back, on a series of enlarged scales, which are also partly embedded in the thick skin. The lateral line fails to reach base of caudal by a distance equaling one-half of head, and is present on eighty-two scales.

Color: Dark olive-brown above, lighter below; a series of about twelve quadrate dark blotches below lateral line, connected more or less by dusky streaks with an alternating series along base of dorsal. No bright colors. Dorsals, pectorals, ventrals and branchiostegal membranes dusky straw-color. Anal black, the rays white-tipped. Caudal blackish. Peritoneum white.

A single specimen from station 2944, in 30 fathoms.

Gillellus gen. nov. (*Leptoscopidae*).

A separate dorsal fin on the nape composed of three spines. Lateral line descending posteriorly, its dorsal and median portions about equal. Fringes of upper lip obsolete, those of lower lip little evident. Head not cuboid, the mouth moderately oblique, the lower jaw rounded in front, and without symphyseal flap.

The physiognomy is intermediate between *Dactyloscopus* and *Myxodagnus*, from both of which the genus is well separated by the characters of the dorsal fin and the lateral line. Named in honor of Dr. Theodore Gill, to whom we owe our knowledge of the previously described members of this most interesting group.

Type, *Gillellus semicinctus* sp. nov.

60. Gillellus semicinctus sp. nov.

Body deep, tapering rapidly either way from front of dorsal. Depth $5\frac{1}{2}$ in length; head $3\frac{2}{3}$. Mouth moderately oblique, the maxillary extending beyond orbit, 3 in head. Tip of lower jaw projecting.

Teeth in a narrow band in front of jaws, becoming a single series laterally; none of the teeth enlarged. Opercular fringes well developed, eight or nine in number. Fold of membrane between rami of lower jaw well developed. Pseudobranchiæ apparently not developed. Gill rakers obsolete.

Dorsal fin beginning at a distance from occiput less than diameter of eye. The first three rays are entirely detached from the rest of the fin, the first ray the highest, the second and third shortened. Of the remaining part of the fin, the first nine or ten rays are unarticulated and spinous. First two anal rays not articulated. Caudal about $1\frac{3}{4}$ in head. Pectorals $1\frac{1}{2}$.

D. III-IX or X, 28; A. II, 30 or 31. Lat. l., 25 to 28-3-15 to 18 (43 to 49 scales in all).

Lateral line running anteriorly along the very base of spinous dorsal, no scales intervening between it and base of fin. It descends to

middle of sides posteriorly; the median portion of its length shorter than the dorsal portion.

Color: Light olivaceous, the back with six broad cross-bars of pink, narrowly margined behind and in front with blackish, terminating below on middle of sides. The lower of these bars is frequently black. A black bar across caudal peduncle, and sometimes a black line at base of caudal. Along median line of sides frequently a series of small black spots alternating with the cross-bars. A similar series along median dorsal line. A large pink blotch covering occiput. A dusky bar across interorbital space, running downwards and backwards across cheeks. Silvery spots and blotches on cheeks and anterior portions of opercles. Fins unmarked.

Specimens have been obtained in the Pacific by the *Albatross*, at Stations 2827 and 2829, and by the *Grampus* in the Atlantic, at Stations 5108 and 5112. I am unable to detect any specific difference between the two.

61. *Gillellus arenicola* sp. nov.

Body very slender and elongate, much as in *Myxodagnus*, the snout sharp, the mandible produced at symphysis and conspicuously projecting.

Labial fringes apparently obsolete. Maxillary reaching vertical from middle of orbit. Eye small, about equaling length of snout, 6 in head. Opercular fringes nearly obsolete, three or four small ones at upper edge of opercle.

Anterior dorsal inserted close behind occiput, composed of three rays, and separated by a short interspace from rest of fin. Pectorals longer than head.

Head $4\frac{2}{3}$ in length; depth $8\frac{1}{3}$. D. 3-40; A. II, 35. Lat. l. 18-3-27.

The lateral line anteriorly runs along base of dorsal, from which it is not separated by intervening scales. The anterior portion is contained $2\frac{1}{3}$ times in the posterior median portion.

Color: Light olivaceous, the head with grayish blotches and small pearly spots. Eleven dark bars downwards from back, the alternate ones narrower and fainter and not extending to middle of sides, as do the others. The margins of the larger bars are darker than the median portion. The bars are not continued onto dorsal fin; all the fins translucent.

A single specimen, $1\frac{1}{2}$ inches long, from Cape San Lucas.

62. *Dactyloscopus lunaticus* sp. nov.

Depth greater than in related species, $5\frac{1}{4}$ in length; head (to end of opercular fringes) $3\frac{2}{3}$; from tip of lower jaw to base of fringes 4. Head cuboid, narrowed forwards, the vertex gently convex; width at occiput half length of head (to base of fringes on opercle). Mouth nearly vertical, maxillary $2\frac{2}{3}$ in head. Labial fringes short but evident. A short nasal filament.

Teeth in a rather broad cardiform band on front of upper jaw, becoming narrow laterally. In lower jaw a single series, or an irregular double series anteriorly. Vomer and palatines toothless.

Eyes small, very close together, the interorbital width about half their diameter, which equals length of snout, and is about one-eighth head. Gill laminae much reduced in size; a small round pore behind inner arch. Gill rakers obsolete; pseudobranchiae small but evident. Opercular fringes composed of eighteen filaments.

Dorsal beginning at a distance behind occiput equaling diameter of orbit. The anterior rays are but partly joined by membrane, the first ten or eleven slender and not articulated. The last ray is distant from base of caudal about a diameter of orbit. Origin of anal under sixth dorsal spine, the two anterior rays not articulated. Pectorals short, $1\frac{2}{3}$ in head, containing fourteen or fifteen rays. Caudal very small, with ten developed rays, its length $2\frac{3}{4}$ in head.

D. X or XI, 29 or 30; A. II, 32 or 33; lateral line running high in its anterior portion, declining on three or four scales, the posterior portion on middle of sides with twenty-nine or thirty tubes. Four scales between median portions of lateral line and base of dorsal.

Color: Light olivaceous, a dark streak along back, one along middle of sides, and a fainter one along base of anal, formed by darker margins to the scales. Median dorsal line with ten or eleven more or less evident narrow pearly white cross-bars. Top of head and front of mandible colored like the back, the pearly blotches varying in size and shape, but symmetrically arranged, many of them narrowly edged with black. Nasal tentacle white. White streaks on preopercle. Caudal with a narrow black bar at base.

Three specimens, the longest 3 inches, from Stations 2797 and 3012, the latter in 22 fathoms.

63. *Labrosomus cremnobates* sp. nov.

Differing from other described species of this genus in the much larger scales. Head $3\frac{1}{2}$ in length; depth $4\frac{3}{4}$. D. XXI or XXII, 8; A, II, 19, Lat. l. 37. L. $1\frac{1}{2}$ inches.

In appearance resembling very strongly the species of the genus *Auchenopterus*. Body slender, snout sharp, the jaws equal. Mouth wide, oblique, the maxillary reaching vertical from posterior margin of orbit, $2\frac{1}{4}$ in head.

Teeth small, villiform, forming a band in front of upper jaw, the outer series enlarged. In lower jaw a single series laterally, becoming double in front. Similar teeth on vomer and palatines. Eye longer than snout, 4 in head. Interorbital width less than diameter of pupils. Opercle terminating in an evenly convex process behind, without spinous points. Gill membranes broadly united, free from isthmus. No hook on inner edge of shoulder girdle. Nostrils with a flap. A single slender filament on eye and one or more on each side of the nape.

A slight notch between first and third dorsal spines and another between the eighteenth and twenty-first spines. The spines are low and strong, the highest equaling the snout and half eye. Soft rays higher, the longest equaling half head. Caudal short, rounded, entirely free from dorsal and anal. Anal similar to soft dorsal; the first two rays spinous. Ventrals inserted well in advance of pectorals, each consisting of one spine and two soft rays, which are joined only at base. Pectorals pointed, the lower rays the longest, $1\frac{1}{2}$ in head.

Scales large, cycloid, the lateral line running high in front, descending to middle of sides immediately behind pectorals, thence running straight to tail. In the types, which are probably immature, the pores are not developed on posterior part of body.

Color in spirits: Uniform light olivaceous, a small dusky spot behind orbit and one below and behind it. Opercle dusky. In one specimen the rays of soft dorsal, anal, and caudal are finely barred with dusky.

Two specimens. Station 3001; in 71 fathoms.

Cryptotrema gen. nov. (*Blenniidae*).

Differing from *Labrosomus* in the absence of nuchal filaments and in the modified anterior portion of the lateral line, which runs on a series of enlarged scales having no externally visible pores.

Type, *Cryptotrema corallinum* sp. nov.

64. *Cryptotrema corallinum* sp. nov.

Body elongate, the greatest depth $5\frac{1}{2}$ in length, regularly tapering backwards to caudal peduncle, whose depth equals length of snout. Head $3\frac{1}{2}$ to 4 in length, the snout sharp, the mouth nearly horizontal, the maxillary reaching middle of eye or beyond, $2\frac{1}{2}$ to $2\frac{1}{2}$ in head. Teeth strong, but none of them enlarged, in a single series in jaws laterally, becoming double anteriorly. Teeth on vomer and in a small distinct patch on front of palatines.

Eyes large, the interorbital space flat, nearly half diameter of orbit. Orbit slightly exceeding length of snout, $3\frac{1}{2}$ in head. Branchiostegal membranes broadly united, free from isthmus, the posterior edge on vertical from preopercular margin. Anterior nostril in a short tube, a slender flap arising from its posterior margin. A pair of simple slender filaments arising from the upper edge of each orbit, one on each side of nape; none others on head. Gill-rakers very short and weak. Shoulder girdle without hook on its inner edge.

Scales rather large, cycloid, the head alone naked; lateral line in its upper anterior portion without externally visible tubes, its position shown by a series of enlarged scales twice the size of the others. On these the tubes are wholly on the under side, each opening anteriorly by a single pore under the edge of the preceding scale. Anteriorly the lateral line runs near the back and parallel with it, becoming suddenly declined behind middle of trunk, thence running on middle of

sides. The oblique portion of lateral line rests on about seven scales, and the externally visible tubes of lateral line begin at this point. Posterior portion of lateral line contained $1\frac{1}{2}$ to $1\frac{3}{4}$ in dorsal portion. Scales of lateral line: Forty-five in dorsal portion, seven in oblique portion, and eighteen in posterior portion.

A slight notch behind fourth dorsal spine, the second and third spines slightly longer than those following, the first little longer than the fourth, the longest spine about $2\frac{1}{4}$ in head. First two anal rays spinous, but weak and flexible. Last dorsal and anal rays not joined by membrane to caudal peduncle, the depth of the latter equaling the length of its free portion. Ventrals long and narrow, nearly reaching vent in males, consisting of one spine and three simple rays. Pectorals with some of the lower rays longest, $1\frac{1}{5}$ in head.

All of pectoral rays simple, fourteen in number.

D. XXVII, 12; A. II, 27. L. 5 inches.

Caudal fin truncate, $1\frac{2}{5}$ to $1\frac{1}{2}$ in head.

Color: Dusky olive above, with irregular narrow longitudinal streaks of bright coral red, and seven round black blotches above middle of sides. Reticulating red lines and spots on top and sides of head and snout. Branchiostegal membranes dusky in males. Two red streaks on base of pectorals. Dorsals somewhat dusky, marked with lines of red spots. Caudal with three rather faint cross-bars. Pectorals, ventrals, and anal largely black in males, pale in females.

Three specimens from station 2945, in 30 fathoms.

Plectobranchnus gen. nov. (*Blenniidae*).

Teeth conic, on jaws, vomer, and palatines, some of them canine-like. Body scaly; lateral line obsolete, its course indicated by a lighter streak on middle of sides. Gill slits not continued far forwards, the membranes broadly united, wholly free from isthmus. Dorsal of spines only. Anal with two spines. Ventral with one spine and three well-developed rays. Lower pectoral rays longest, as in *Leptoclinus*.

Type, *Plectobraichus evides* sp. nov.

65. *Plectobranchnus evides* sp. nov.

Body very slender, the depth nearly constant throughout, about one-eleventh of the length. Caudal peduncle without free portion, its depth $2\frac{1}{2}$ in that of body.

Head rather long, $4\frac{3}{4}$ in length, extending well beyond origin of dorsal fin.

Upper jaw with a broad inner band of minute teeth in front and on the sides, the outer series enlarged, two in the front of the jaw distinctly canine-like. Teeth in the lower jaw similar to the outer series above, in a single series laterally, forming a patch in front of jaw, where two of them are much enlarged canines, the largest teeth in the jaws. Vomer and palatines with bands of small but very evident teeth.

Eyes large, close together, the interorbital space half pupil. Orbit $3\frac{1}{5}$ in head, longer than snout. Posterior nostril with a short flap, the tube obsolete. Mouth large, somewhat oblique, maxillary reaching middle of orbit, $2\frac{1}{5}$ in head. Top of head with very large pores, a series running backward from each eye, the two joined by a cross-series on occiput.

Body covered with very small cycloid scales, including belly, nape, breast, and cheeks, those on breast and cheeks not imbricated. Lateral line without visible pores.

Spinous dorsal beginning well forward, the distance from its origin to nape less than from latter to posterior margin of orbit. Anterior spines short, but fully united by membrane, the longest spine $3\frac{1}{2}$ in head. Membrane of last spine reaching base of upper caudal rays. Origin of anal very slightly in advance of middle of body. Anal with two short, sharp spines, the rays longer, their terminal third free from membrane. Last anal ray connected with base of lower caudal ray.

Ventrals well developed, nearly half head. Pectorals with lowermost rays abruptly lengthened, two-thirds head. Caudal short, rounded, little more than half head.

D. LVI; A. II, 34.

Color: Dusky olive above, lighter below; sides crossed by about 25 narrow white bars, narrower than interspaces. Three equi-distant dark blotches near back, each double, the two halves occupying contiguous interspaces between white bars. Branchiostegal membrane black. Head without markings. Pectorals white at base, the distal half black, margined with white. Ventrals white. Dorsal with alternating oblique bars of white and blackish, two jet-black roundish spots on its posterior portion. Caudal whitish at base, then dusky, margined with white, its upper ray jet black. Anal light at base, becoming black at edge of membrane, the free tips of rays white.

A single specimen, 4 inches long, from Station 3064, in 46 fathoms.

Lucioblennius gen. nov. (*Blenniidae*).

Body very elongate, wholly naked; gill membranes broadly united, free from isthmus; dorsal fin single, extending along the entire back, its anterior half spinous. Ventrals in front of pectorals, I, 2. First two anal rays spinous. Last rays of dorsal and anal joined to caudal. Teeth conic, not movable, in jaws and on vomer and palatines.

Type, *Lucioblennius alepidotus* sp. nov.

66. **Lucioblennius alepidotus** sp. nov.

Body much compressed, slender throughout, the head rather deeper and wider than body. Snout long, depressed, and rather wide; the anterior profile descending very gradually. Mouth nearly horizontal, the lower jaw protruding, the gape extending to much behind orbit, the entire physiognomy remarkably pike-like.

Snout one-fourth head; maxillary $1\frac{3}{4}$; eye, $4\frac{2}{3}$ to 5. Head 3 in length. Depth $3\frac{1}{4}$ in head. D. XVIII, 32; A. II, 30. Length $1\frac{1}{2}$ inches.

Teeth in a villiform band in upper jaw, the outer series slightly larger. In lower jaw in a single series laterally, widening into a patch anteriorly, the outer enlarged. A few teeth only on vomer; palatines with a long and rather broad patch similar to those in jaws.

Dorsal fin beginning on the nape in advance of middle of opercle; the fin is uniformly low, extending the whole length of back, the posterior ray joined by membrane with the caudal; the spines and rays are similar in appearance, flexible and simple, none of the soft rays branched. The spines are more slender, and show no joints, the articulations being present in small number on all the soft rays. The highest ray is less than diameter of orbit.

Anal and caudal rays similar to those of soft dorsal. Caudal short, rounded. Origin of anal midway between tip of snout and end of caudal fin, its first two rays spinous. Ventrals under opercular margin, of one spine and two well developed rays, nearly one-half as long as head. Pectorals narrow, of apparently unbranched rays, about half as long as head.

Color: Light olivaceous, with eleven vertical dark blotches on sides, most of which divide to form on middle of sides double vertical bars. Top and sides of head with dark cloudings, and with numerous black specks of varying size. Middle of sides and base of dorsal with numerous pearly dots nearly as large as pupil. Branchiostegal membrane black posteriorly. The lateral bars are extended to base of dorsal, the anterior ones usually forming conspicuous black blotches which extend well up on the fin. Other fins unmarked.

Two specimens from Station 3005, in 21 fathoms.

67. *Lycodes porifer* sp. nov.

Body very slender, the depth 14 in length; head $5\frac{2}{5}$. Head much contracted opposite orbits, the snout expanded, as in *Lycodopsis pacificus*. Mouth moderate, the maxillary reaching vertical from front of pupil, $3\frac{4}{5}$ in head; eye, $5\frac{2}{3}$; snout, $3\frac{2}{5}$; interorbital width, one-third eye.

Teeth in front of premaxillaries in two series, merging into one laterally, the outer series anteriorly somewhat enlarged. Teeth in front of mandible in a broad band, narrowing laterally to a single series, none of them enlarged. Vomer and palatines with single series.

Head with two series of large and very conspicuous elongate pores, one series on mandible and subopercle, the second parallel with it on level of snout.

Gill openings wide, extending forwards beyond preopercular margin, the width of isthmus less than one-fourth length of slit.

Distance from origin of dorsal to tip of snout, $4\frac{1}{3}$ in length. Median dorsal rays simply forked near base, those posteriorly in both dorsal

and anal repeatedly subdividing. Distance of anal from snout, $2\frac{7}{8}$ in length.

Pectorals rounded, the lower half of fin longer than the upper, the rays thickened. The fin contains fifteen or sixteen rays, its length less than half head. Ventrals longer and slenderer than usual, each apparently composed of two rays closely joined, their length three-fourths orbit. They are inserted unusually far forwards, being in advance of preopercular margin.

Scales very small, circular, partially imbedded, covering body and vertical fins. Head, antedorsal region, breast, and a strip connecting the two latter embracing base and axil of pectorals, naked.

Color: Dusky-brown, the fins, sides of head, and belly blackish. Lining of mouth and gill cavity, and peritoneum black.

A single specimen, 12 inches long, from Station 3009, in 857 fathoms.

68. *Lycodopsis crotalinus* sp. nov.

Body very slender, the depth 12 in length; head, $5\frac{1}{2}$.

With much the appearance of *Lycodes parillus*, the cheeks tumid, much projecting laterally, the greatest width of head more than half its length. Snout short and broad, much depressed, the head scarcely constricted opposite orbits. Eyes with little lateral range.

In the single type specimen, the upper jaw greatly overlaps the lower, the mandibular band of teeth shutting entirely within those on premaxillaries. Maxillary reaching to behind middle of pupil, $2\frac{2}{5}$ in head; eye, 6; interorbital width, 14; snout, 4.

Teeth in upper jaw in a single series, two or three small teeth sometimes present anteriorly, giving traces of an inner series. In lower jaw the teeth are sparsely set in a broad band anteriorly, becoming suddenly contracted to a single series on middle of sides. None of the anterior mandibular teeth enlarged, two or three of posterior teeth on sides larger and hooked backwards. No teeth on vomer or palatines.

Nostril in a short tube. Gill slits wide, reaching to below pectorals, but not extending farther forwards below than above. Width of isthmus one-third length of slit.

A series of seven pores along mandible and preopercle; a second series of seven or eight extending from snout along sides of head above premaxillaries.

Dorsal inserted over middle of pectorals, its origin as far from occiput as is the latter from front of pupil. Distance of front of anal from snout equals one-third length of body. Ventrals short, less than length of pupil. Pectorals with posterior margin obliquely truncate, the upper rays longest, the lower growing regularly shorter, thickened at tips. The fin has fifteen or sixteen rays, the longest $2\frac{2}{5}$ in head.

Scales small, imbedded, covering body and most of vertical fins. A few very small, scattered scales on nape, posterior part of occiput, and contiguous parts of cheeks and opercles. Lateral line single, indis-

tinct, running obliquely downwards to near base of anal, thence backwards, not reaching base of caudal fin.

Color: Dark-brown, black on opercles, sides of snout, fins, and lower parts generally. A broad light bar across head behind eyes, extending down on cheeks; some light mottling on mandible and gular membrane. Lower rays of pectorals margined with whitish. Lining of mouth, gill cavity, and peritoneum jet-black.

A single specimen, 13 inches long, from Station 2980, in 603 fathoms.

69. *Lycodopsis crassilabris* sp. nov.

Body exceedingly slender, the depth 16 in length; head $6\frac{3}{4}$. Occiput flat, forming a right angle with the descending cheeks, the snout short and wide, the upper lip conspicuously thickened and fleshy on the sides. Maxillary reaching vertical from front of pupil, 3 in head; exposed portion of eye 6; snout 4; width of snout 3.

Upper jaw with a single series of rather large distant teeth; mandible with a broad patch of cardiform teeth anteriorly, which becomes abruptly constricted on middle of lateral portion of jaw, the inner series alone continued backwards towards angle. Palate smooth.

Head not conspicuously excavated with mucous canals; series of pores present on mandible and sides of head. Gill openings continued forwards to below pectorals, and about to vertical from middle of opercle; the width of the isthmus one-fourth the length of slit. Opercular flap with a wide membranous border, produced backwards and largely covering base of pectorals. Gill-rakers very little developed, about twelve movable rudiments on horizontal limb of arch.

Origin of dorsal in front of middle of pectorals, slightly farther from occiput than is the latter from front of eye. Distance from origin of anal to tip of snout $3\frac{1}{3}$ in total length. Ventrals nearly as long as eye, inserted under middle of opercle. Pectorals with fourteen or fifteen rays, the upper portion of fin longest, the lower rays rapidly shortened, the longest rays half as long as head.

Scales small, circular, covering nape, breast, and under side of pectorals, but absent on head. Lateral line single, inconspicuous, running below middle of sides, the pores not developed on the scales.

Color: Light-brownish above, dark below; lower side of head, margins of snout, gill membranes, part of opercles, and margins of vertical fins jet black. Ventrals and posterior face of pectorals black; anterior face of pectorals light glaucous-blue, margined with black. Lining of mouth and gill cavity and peritoneum black.

A single specimen, 12 inches long, from Station 2839.

Aprodon gen. nov.

Differing from *Lycodes* only in dentition, the teeth being present in a single strong series on the palatines, but none on the vomer. The genus is thus intermediate between *Lycodes* and *Lycodopsis*.

Type, *Aprodon corteziana* sp. nov.

70. *Aprodon corteziana* sp. nov.

Depth 8 to 9 in length; head $4\frac{1}{2}$.

Head high and narrow, snout broader, but long and very convex. Mouth large, maxillary reaching vertical from middle of orbit, $2\frac{1}{3}$ in head; eye $4\frac{1}{5}$; snout 3; depth of head 2.

Teeth in premaxillaries strong, conical, in a single series; lower jaw with the teeth mainly in two series, an outer row of slightly enlarged teeth, and an inner row directed backwards, a wide interspace between the two series with occasional scattered teeth only; posteriorly on sides of mandible a single series of teeth similar to those in upper jaw. Vomer toothless. Palatines with a single series of strong conical teeth.

Head without conspicuous mucous pores. A strong ridge on middle of occiput anteriorly. Gill slit wide, continued forwards to vertical from preopercle, the width of isthmus five times in length of slit. Gill-rakers short, better developed than usual, fifteen on horizontal limb of outer arch. The vertical limb of arches joined to gill cover by a fold of the lining membrane of the latter, as in *Macrurus*. Pseudobranchiæ well developed.

Origin of dorsal but little behind base of pectorals; the hinder margin of occiput midway between dorsal and front or middle of eye. Distance from snout to origin of anal $2\frac{2}{5}$ in total length. Ventrals inserted under front of opercles, their length about three-fifths of orbit. Pectorals very large, broadly rounded, the upper portion of fin longest, the lower rays rapidly shortened, the lowermost with broad, fleshy tips; rays twenty or twenty-one in number.

Scales of the usual type, those on abdomen so deeply embedded as to be almost invisible; head, anterior half of nape, breast, and base of pectorals naked; pectorals and ventrals not scaled, other fins partly covered. Lateral line little developed, running along middle of sides and tail.

Color: Light-brownish, lighter below; vertical fins broadly margined with black, becoming almost wholly black behind. Pectorals light at base, black distally, with a conspicuous white edge. Ventrals white. Lining of mouth white, of gill cavity dusky; peritoneum black.

Six specimens, the longest 15 inches, from Stations 2925 and 2948, in 339 and 266 fathoms.

Lycodapus gen. nov. (*Lycodidae*).

Body naked. Ventrals wanting. Vertical fins united around the tail. Gill openings wide, continued forwards under the throat; the gill membranes anteriorly narrowly united, loosely joined to the isthmus by a fold of lax skin. Branchiostegals, six. No pseudobranchiæ. Gills, four; a wide slit behind inner arch. Gill-rakers developed. Teeth present in jaws and on vomer and palatines, none of them enlarged. Vent remote from the throat.

Type: *Lycodapus fierasfer* sp. nov.

71. *Lycodapus fierasfer* sp. nov.

Body compressed, elongate, tapering rather rapidly backwards, the tail not produced to a filament. Head flat above, the cheeks deep, vertical, the mouth very oblique, with the lower jaw slightly the longest and nearly entering the upper profile. Skull very thin and papery, translucent.

Jaws weak; gape of mouth wide, the maxillary reaching vertical from behind front of pupil, 2 to $2\frac{1}{2}$ in head; eye $4\frac{1}{2}$; snout $3\frac{1}{2}$. Teeth all small, in a very narrow band in jaws, in a single series on vomer and palatines. Interorbital width two-thirds of eye.

Snout broad, depressed, spatulate; its tip prominent, turned upwards, the upper profile thus longitudinally concave. An evident median ridge on snout and interorbital space. Gill slits continued forwards below to vertical from middle of eye, the membranes united for a distance equaling diameter of pupil. Gill-rakers short, less than diameter of pupil, strongly toothed, about ten on horizontal limb of arch. Head without conspicuous mucous pores or cavities.

Dorsal beginning well forwards, its distance from occiput slightly less than that from occiput to nostril. The dorsal and anal rays are slender, all articulated, branched only at tips. Caudal not distinct, the rays springing from end of tail not projecting beyond the others.

Origin of anal immediately behind vent, its distance from snout nearly equaling one-third total length. Ventrals narrow, varying in length, about $2\frac{1}{2}$ in head. Body and fins invested in a rather lax transparent skin, without trace of scales.

D. 82; A. 70. Head $5\frac{1}{2}$ in length; depth 10.

Color: Body translucent, dusted with black specks. Abdomen blackish. Lips, inside of mouth, lining of gill cavity, and peritoneum jet-black. Iris silvery.

Several specimens, the longest $5\frac{1}{4}$ inches, from stations 2980, 3010, 3072, in 610 to 1,005 fathoms.

72. *Leptophidium pardale* sp. nov.

Light-olive, a series of eight black bars downwards from back, scarcely reaching lateral line, sometimes continuous with their fellows of the other side, and alternating with smaller black spots on dorsal outline; below the smaller spots a series of round spots nearly as large as eye along middle line of sides. Sides and lower parts of head and body dusted with rather coarse black specks. Dorsal light, the margin with ten elongate black blotches, usually longer than the interspaces. Caudal dusky at base, its distal half white. Anal wholly black. Peritoneum and lining of gill cavity white.

Head $5\frac{1}{2}$ in length; depth $8\frac{1}{2}$; L. $7\frac{1}{3}$ inches.

Body very slender, with a short head and small mouth; maxillary scarcely reaching vertical from posterior border of orbit, its length $2\frac{1}{6}$ in head. Outer teeth very little enlarged, not movable; teeth present

on jaws, vomer, and palatines. Eye $3\frac{2}{3}$ in head; snout $4\frac{2}{3}$; interorbital width two-thirds eye. Gill-rakers slender, the longest one-fourth eye, four developed. Tip of snout with a strong, concealed spine, as in *L. prorates*. Opercle ending in a short spine.

Nape midway between front of dorsal and front of pupil. Dorsal beginning over middle of pectorals, which are $2\frac{1}{4}$ in head. Ventral filaments very short; the inner the longest, $4\frac{2}{3}$ in head.

Scales very small, about two hundred in a longitudinal series extending forwards on top of head to middle of interorbital space. Cheeks and opercles scaly.

A single specimen, from Station 3014, in 29 fathoms.

73. *Leptophidium microlepis* sp. nov.

Closely related to *L. prorates*, differing principally in the much smaller scales.

Head $4\frac{2}{3}$ in length; depth $7\frac{1}{2}$ to 8.

Rostral spine very strong as in *prorates*. Eye $4\frac{1}{4}$ to 5 in head; snout 5; interorbital width $6\frac{1}{2}$; maxillary extending beyond orbit, $2\frac{1}{4}$ to $2\frac{1}{2}$.

Outer teeth enlarged, not at all movable, those in upper jaw largest. Four gill-rakers developed, the longest $3\frac{1}{2}$ in eye. Opercle ending in a short concealed spinous point.

Dorsal inserted in front of middle of pectorals, the distance from nape to front of dorsal usually less than from nape to middle of eye. Longest ventral filament $3\frac{1}{3}$ to $3\frac{1}{2}$ in length of head. Pectorals $2\frac{1}{4}$ to $2\frac{1}{2}$ in head.

Scales exceedingly small, regularly imbricated, in about two hundred and fifty transverse series, thirty-five transverse series between nape and dorsal (about one hundred and seventy-five transverse rows in *prorates*, twenty-five series between nape and dorsal). Top of head scaly as far as front of eyes. Cheeks and opercles scaly.

Color as in *prorates*, the lining of peritoneum and gill cavity silvery white, the former with little or no black specking.

Many specimens, the longest 14 inches, from Stations 3015 and 3016, in 145 and 76 fathoms.

74. *Leptophidium stigmatistium* sp. nov.

Much resembling *L. prorates*, differing in dentition, in gill-rakers, and in color.

A strong rostral spine. Head $4\frac{1}{2}$ in length; depth $9\frac{1}{4}$. Eye $4\frac{1}{3}$ in head; snout 6; interorbital width $6\frac{1}{2}$; maxillary reaching slightly beyond posterior border of eyes $2\frac{3}{4}$ in head. Outer teeth scarcely enlarged, evidently so only in front of upper jaw. Gill-rakers long and slender, strongly curved forwards at tip, the longest equaling one-half eye; seven well developed rakers present. Opercle ending in a rounded process, a broad soft flap projecting beyond it.

Dorsal inserted behind middle of pectorals, the nape equidistant from

front of dorsal and base of rostral spine. Pectorals $2\frac{2}{3}$ in head. Longest ventral filament $2\frac{3}{4}$ in head.

Scales small, about as in *prorates*, one hundred and eighty transverse series, twenty-eight in front of dorsal, continued forwards on top of head to front of pupil. Cheeks and opercles scaly.

Color: Dusky olivaceous, lighter below; dorsal with a large black blotch on anterior rays, the margin obscurely dusky; anal broadly margined with jet-black; caudal with median rays black at base, the outer rays and the margin light. Lining of gill cavity jet-black. Inside of mouth white. Peritoneum bright silvery.

A single specimen 10 inches long, from Station 2996, in 112 fathoms

75. *Leptophidium emmelas* sp. nov.

Body deep, compressed, its height $5\frac{2}{3}$ to 6 in length; head $3\frac{3}{4}$ to 4. Maxillary reaching slightly beyond orbit, $2\frac{1}{3}$ to $2\frac{1}{4}$ in head. Jaws slender and weak, the teeth in very narrow bands, the outer not enlarged. Eye as long as snout, $4\frac{3}{4}$ in head; interorbital width 7. Rostral ridge very sharp, bearing a flat spine at its base directed upwards and backwards, terminating in a very slender sharp spine anteriorly.

Opercle ending in a weak spinous point behind. Gill rakers short and slender, the longest half pupil, eight or nine movable ones developed. Skull and all bones of head very thin and papery.

Dorsal beginning over base of pectorals, the nape midway between its origin and middle of orbit. Distance from snout to origin of anal $1\frac{1}{3}$ in distance from latter to end of tail. Pectorals half length of head. Ventral filament $2\frac{3}{4}$ in head.

Scales large, eight between lateral line and front of dorsal, covering cheeks, opercles and top of head forwards to middle of interorbital space. About one hundred and twenty-five transverse rows on sides, eighteen or twenty before dorsal. Vertebrae 13+41.

Color: Brownish, much dusted with minute specks; fins blackish, the vertical fins with an indistinct narrow whitish margin. Inside of mouth dusky; the roof of mouth, lining of gill cavity, and peritoneum jet-black. Many specimens, the longest 9 inches, from Stations 3007 and 3008, in 362 and 306 fathoms.

76. *Otophidium galeoides* sp. nov.

Closely related to *O. taylori* and *O. indefatigabile*, differing from both in color, from the former in gill-rakers, and from the latter in the much shorter head, smaller mouth, less imbricated scales, the more posterior insertion of dorsal, and the absence of spines on head.

Head $5\frac{1}{2}$ in length, depth 6. Maxillary reaching beyond pupil, $2\frac{1}{3}$ in head; snout $4\frac{2}{3}$; eye $3\frac{3}{5}$. D. 125. Gill-rakers short and broad, four of them developed. Opercle ending in a sharp concealed spine. Outer teeth little enlarged.

Dorsal beginning over middle of pectorals, the nape equidistant be-

tween front of dorsal and tip of snout. Caudal very short and bluntly rounded, as in *O. taylori*, the rays not projecting beyond dorsal and anal. Pectorals $1\frac{2}{3}$ in head. Ventral filament half head.

Scales as in *taylori*, not at all imbricated, arranged with their long axes frequently at right angles to each other. Head naked.

Color: Light olive, without bars, a narrow dusky streak along base of dorsal, and a round light spot at origin of dorsal. A series of small olive-brown spots along lateral line, with a few scattering spots below it but none above. Nape and head without spots. Vertical fins translucent. Dorsal with a large black blotch on tip of anterior rays, the fin behind this narrowly edged with black, which does not surround the caudal. Anal with much silvery-white pigment anteriorly on distal portion, becoming dusky behind. Pectorals translucent, edged with white below. Peritoneum, buccal, and gill cavities white.

One specimen, $5\frac{1}{2}$ inches long, from Station 3025, in $9\frac{1}{2}$ fathoms.

77. *Catætyx rubrirostris* sp. nov.

Closely related to *C. messieri*, differing in the shorter, broader snout, the wider preopercle, the more anterior origin of anal, and apparently in the gill-rakers and pores on head.

Depth of body below origin of dorsal equals one-third distance from end of snout to vent, 7 in length; head 4; distance from snout to origin of dorsal $3\frac{1}{5}$; from snout to vent $2\frac{2}{7}$; maxillary extending beyond eye, $2\frac{2}{5}$ in head; eye equaling snout, $5\frac{1}{2}$; interorbital width 7; width of snout $3\frac{1}{5}$.

Teeth in upper jaw in a narrow band, minute, compressed, narrowly triangular, none of them enlarged. In the lower jaw a still narrower band of similar teeth, the posterior row slightly enlarged, and increasing a little in size on sides of jaw, where it is accompanied by a single series only of the smaller teeth; this lateral series is continued backwards far beyond premaxillary band. Teeth on vomer and palatines similar to those in sides of lower jaw, the former in a V-shaped patch, the latter in a long and very narrow band.

Anterior nostril in a short tube at tip of snout, the posterior large, without tube, immediately in front of eye. System of mucous pores well developed but not conspicuous, the pores collapsing on account of the thinness of the skin covering head. The large mucous tube below eye extends around front of snout and opens by slit-like pores along edge of snout and lower margin of infraorbital flap; it opens posteriorly by a vertical slit half as long as pupil, immediately above end of maxillary. Another series of pores along mandible and at edge of expanded limb of preopercle. No other evident pores.

Angle of preopercle much expanded, its width equaling diameter of pupil. A sharp strong spine arising from anterior portion of opercle, the structure of the gill-flap apparently like that of *Neobythites stelleroides*. A short sharp spine directed backwards immediately behind

posterior nostril. No other spines on head. Gill openings wide, continued forwards to below posterior margin of orbit, the membranes wholly free from the isthmus. Gill-rakers short but not very broad, about half length of pupil, only two or three developed immediately in front of angle of arch.

Dorsal beginning over or slightly behind middle of pectorals, the distance from its origin to occiput equaling or somewhat exceeding distance of latter from tip of snout. Dorsal and anal fully united to caudal. The caudal has a base of appreciable width, bearing about twelve close-set rays, which extend much beyond tips of last dorsal and anal rays. Origin of anal nearer snout than base of caudal.

Ventrals slender, each consisting of a single ray, inserted very near together, under anterior portion of opercle, their length about equaling that of maxillary. Pectorals with about twenty-three rays, evenly rounded behind, their length $1\frac{2}{3}$ in head.


Scales very small, cycloid, regularly imbricated, in about one hundred and thirty-five transverse series. The nape and belly are scaled, as is also the head, excepting snout, mandible, suborbital, and sometimes interorbital areas.

Color: Dusky olive, the ventrals white, the other fins black, at least on distal portions. Opercles, gill membranes, sides and top of snout, and posterior portion of abdomen, blue black. The snout flushed with dark ruby-red in life. Lining membrane of mouth and gill cavity, and peritoneum, jet-black.

Four specimens, the longest $4\frac{1}{2}$ inches in length, from Stations 2909, 2925, and 2936, in 205 to 359 fathoms.

78. *Neobythites stelliferoides* sp. nov.

Head 4 to $4\frac{1}{2}$ in length; depth, 5 to $5\frac{1}{4}$. D. 95, A. 82. Scales in about one hundred and ten transverse rows. Physiognomy strikingly like that of *Stelliferus*. Mouth large, oblique, the lower jaw included, maxillary reaching well beyond orbit, half length of head.

Teeth uniform, small, in narrow bands, those on vomer in a  shaped patch; a well-developed band on palatines; tongue smooth, a well-developed denticerous crest on median line behind it. No barbel at symphysis.

Snout short, bluntly rounded, about equaling diameter of orbit, slightly overhanging mouth, 5 in head; interorbital width, 4. Upper limb of preopercle extending obliquely downwards and backwards, largely adnate, the angle produced into a free membranous flap which entirely conceals the narrow interopercle, and bears no spines.

The structure of the gill-flap does not appear to have been correctly interpreted. The opercle is strong, but of small extent, forking at its base, one branch continued straight backwards as a strong spine, the second a narrow flat process downwards and somewhat backwards, parallel with and little distant from margin of preopercle. Filling the

deep notch between these two processes, and forming the greater portion of the gill-flap, is the thin membranous subopercle. Branchiostegal rays seven. Gill-rakers long and slender, the longest three-fourths diameter of orbit, seven above angle, thirteen and about five rudiments below.

Nape midway between front of dorsal and front of eye. Dorsal and anal similar, uniform, low, joined to base of caudal; the latter truncate, projecting well beyond them. Ventrals inserted under angle of preopercle, each of a single ray forked to the very base, the two branches united by membrane for a distance equaling two-thirds orbit. The inner filaments are the longest, one-third longer than head, and extend well beyond front of anal. Pectorals long and narrow, $1\frac{1}{2}$ in head; a narrow membranous flap connects base of pectorals with upper angle of opercular flap.

Scales small, well imbricated, entirely investing body and head, including gular membrane and part of gill membranes. Lateral line nearly complete, lacking for about one-seventh length of body, running high, parallel with dorsal outline.

Color: Silvery gray, dusted with coarse black specks, darker along dorsal outline. Dorsal and anal with a narrow light streak at base, otherwise dusky, becoming black posteriorly, and with a narrow white margin. Caudal black, with a broad white terminal bar. Pectorals and ventrals white, with few black specks. Peritoneum silvery white. Mouth white anteriorly; its posterior portion and gill cavity jet-black.

Many specimens from Station 2996, in 112 fathoms. Length 7 inches.

79. *Physiculus rastrelliger* sp. nov.

Head $3\frac{1}{2}$ in length; depth $4\frac{3}{4}$. Length of caudal peduncle to base of median caudal rays, three-sevenths head. Snout short and broadly rounded, $4\frac{1}{4}$ in head; eye $3\frac{2}{5}$; interorbital width $4\frac{1}{3}$ to $4\frac{2}{3}$; maxillary $2\frac{1}{4}$, extending to vertical from posterior margin of pupil.

Teeth in rather broad bands, none of them enlarged; width of patch on premaxillaries half pupil; vomer and palatines toothless. Branchiostegal membranes broadly united, joined to the isthmus anteriorly, the width of the free fold more than half pupil. Gill-rakers numerous, slender, moderately long, the longest one-third diameter of orbit, about seven above angle, seventeen to nineteen below, the anterior ones short but movable.

Origin of first dorsal slightly in advance of base of pectorals, its distance from tip of snout $3\frac{2}{7}$ in length. Base of first dorsal equaling length of snout, its longest ray $2\frac{2}{5}$ in head. Free portion of caudal peduncle equals diameter of eye.

Second dorsal notched, the median rays three-quarters the height of the highest anterior rays, the posterior highest, equaling first dorsal and longest caudal rays. Anal similar to soft dorsal, but lower. Ventrals under middle of opercle, the distance between their bases little

less than interorbital width, equaling distance from vent to anal fin. Ventrals with seven rays, the outer two produced, the second the longest, reaching base of seventh or eighth anal ray. Pectorals with broad base, covered with lax membrane, containing twenty-six to twenty-eight rays, their length $1\frac{1}{2}$ to $1\frac{2}{3}$ in head.

D. 8 or 9-53 to 61; A. 57. Lat. l. 100 to 110.

Scales small, comparatively little reduced on top of head, a broad ring encircling snout in front of eyes naked, a very narrow patch of scales between this laterally and premaxillaries. Scales in one hundred to one hundred and ten transverse rows, eight or nine between lateral line and front of dorsal. Lateral line wanting on posterior part of body, in the latter part of its course present on occasional scales only.

Color: Uniform grayish-olive on sides, each scale, or at least its marginal half, closely covered with minute dark specks. Gular and branchiostegal membranes, ventral region, and axil of pectorals blue-black. Basal portion of vertical fins light bluish, margined with blackish. Pectorals dusky; ventrals blue-black at base, the distal portion white. Lining membrane of mouth and gill cavity white; peritoneum silvery, but in places so filled with black specks as to appear black.

Many specimens, the longest 8 inches, from Stations 3045 and 2987, in 184 and 171 fathoms.

80. *Physiculus nematopus* sp. nov.

Head 4 in length; depth 5. Length of caudal peduncle to base of median caudal rays $5\frac{1}{4}$ in head. Snout very broadly rounded, its width twice its length, which is $4\frac{3}{8}$ in head; eye $3\frac{3}{4}$; interorbital 4; maxillary 2, reaching slightly beyond vertical from posterior margin of orbit.

None of the teeth enlarged; palate smooth. Branchiostegal membranes more narrowly joined than in *rastrelliger*, but wholly free from isthmus. Gill-rakers short and slender, eleven movable ones on horizontal limb of arch.

Origin of first dorsal over base of pectorals, its distance from tip of snout $3\frac{2}{3}$ in length. Base of first dorsal equaling snout and half eye, its highest ray $2\frac{1}{4}$ in head. Free portion of caudal peduncle one-third diameter of orbit. Notch of dorsal and anal fins not conspicuous, the posterior dorsal rays little longer than those which precede, $2\frac{1}{2}$ in head; caudal $2\frac{3}{8}$; pectorals $1\frac{1}{2}$. Ventrals with broad base and seven rays, the outer two filamentous, the second the longest, reaching base of tenth to twelfth anal rays, and as long as head. Distance between bases of ventrals equals interorbital width.

D. 7 to 9-56 to 61; A. 59 to 64. Lat. l. 90 to 105.

Scales small, regularly imbricated, becoming minute on snout, which they completely invest as well as mandible and gular membranes. Lateral line present on anterior half of body only; eight scales above it anteriorly.

Color: Light olive-brown sprinkled with dark specks, the sides of

head and trunk with silvery luster. Snout, mandible, and gular membrane dusky; abdominal area, branchiostegal membranes, base of ventrals, axillary blotch, and front of anal purplish-black. Posterior edge of gill membranes and opercular flap white. Dorsals dusky, with an inconspicuous darker margin, which becomes more marked posteriorly. Anal darker, margined with black. Caudal blackish. Pectorals and filamentous portion of ventrals white. Inside of mouth and gill cavity white. Peritoneum silvery, rendered black on sides by clusters of spots.

Many specimens, the largest 7 inches long, from Stations 2997, 3011, 3015 and 3016, in 71 to 221 fathoms.

81. *Macrurus* (*Cœlorhynchus*) *scaphopsis* sp. nov.

Depth $6\frac{3}{4}$ in total length; head $4\frac{1}{6}$. Lat. l. ca. 98. D. II, 8; A. ca. 95.

Snout flattened, acute, the conspicuous infraorbital ridge forming a strong ridge along its sides, the two meeting at tip in a salient point. An evident keel extends from tip of snout to middle of interorbital area. The supraorbital ridge divides anteriorly, one branch running down in front of nostril, the other separating nostril fossa from orbit. Between the ridges the head is covered with a soft, yielding integument, which is semi-translucent.

Lower side of snout wholly naked below, and with a large naked area above on each side of tip. The snout projects beyond the mouth for a distance equaling length of maxillary.

Mouth of moderate size, the maxillary reaching vertical from posterior margin of pupil, $3\frac{1}{3}$ in head. Teeth villiform, in a broad band in upper jaw, in a narrower band below, not reduced to a single series laterally in either jaw, and none of the teeth enlarged.

Eyes large, elliptical, equaling length of snout, $3\frac{1}{4}$ in head; interorbital width $4\frac{1}{3}$. Barbel short, about half pupil. Preopercular angle greatly produced backwards, wholly concealing the interopercle, the strong infraorbital ridge failing to reach preopercular margin by only one-third diameter of pupil. Structure of gills as usual in this genus, the gill-rakers obsolete. Gill membranes broadly united, joined to isthmus, across which they form posteriorly a very narrow free fold.

Besides the ridges already described on head, there are a pair on occiput, a pair from upper posterior margin of orbit to upper angle of gill opening, and a median ridge on nape reaching about half way from occiput to dorsal. These ridges, as well as the interorbital space and the area between the occipital ridges, are covered with scales compressed to a knife-like edge, which is provided with a single series of backward-directed spines. The scales on infraorbital and rostral ridges bear stellate spines or are similar to those on temporal region, sides of head, and body generally.

Scales on body large; three longitudinal series between lateral line and middle of first dorsal. Each scale is provided with a ridge bear-

ing about six backward-directed spines, and from two to four pairs of lateral ridges also bearing spines, the lateral ridges sometimes extending the whole width of scales, sometimes confined to their basal portion; marginal spines longest. Axil of pectorals naked, its base anteriorly with small cycloid scales.

A naked, much depressed, elliptical area between bases of ventrals in all specimens.

Second dorsal spine smooth, weak, little exceeding length of soft rays, equaling length of snout and orbit. Base of first dorsal $1\frac{1}{2}$ in interspace between dorsals, which is $2\frac{2}{3}$ in head. Distance from front of anal to snout equals one-third total length. Ventrals with the outer ray produced, about reaching front of anal. Pectorals reaching beyond anal, half length of head. Ventrals with seven rays. Pectorals with fifteen to seventeen rays.

Color: Light olive-brown, dusted with coarse black specks; axil of pectorals, belly, ventrals, and branchiostegal membranes blue-black; lower side of head dusky. Mouth anteriorly, including tongue and half of palate, white; its posterior part and most of lining of gill cavity jet-black; inner lining of cheeks abruptly white. Lower part of iris silvery. Peritoneum silvery, with coarse dusky specks. Vertical fins dusky, the anterior portion of anal black.

Many specimens, the longest 12 inches long, from Station 3015, in 145 fathoms.

82. *Macrurus* (*Macrurus*) *stelgidolepis* sp. nov.

Head $4\frac{3}{5}$ in length; depth $5\frac{1}{2}$. D. II, 10 or 11; A. 130. Lat. l. ca. 155; five or six scales between lateral line and base of first dorsal.

Body deep, the lower profile rapidly rising along anterior portion of base of anal, the tail thus abruptly becoming slender. Head short and deep; snout heavy, little produced, acute at extreme tip; infraorbital ridge not prominent on sides of head or snout, not continued backwards on preopercle. A pair of narrow transverse naked strips on upper surface of snout near tip, separated on each side by a single scale from the naked nostril fossa. A double series of scales intervenes between the nostrils and the orbit. Lower side of snout wholly naked anteriorly, partly scaled laterally.

Mouth large, overhung by premaxillaries for a distance about one half diameter of orbit. Premaxillaries in advance of nostrils; maxillaries reaching vertical from posterior margin of pupil, $2\frac{2}{3}$ in head; snout about equaling interorbital width, $4\frac{1}{2}$; eye small, $3\frac{1}{2}$ to 4. Barbel long, five-sixths orbit.

Teeth in cardiform bands of equal width in both jaws, narrowed laterally, but not to a single series. Anterior series in upper jaw enlarged, in lower jaw all the teeth of equal size.

Preopercle broadly rounded, the angle but moderately produced, a narrow strip of the interopercle visible for its entire length. Outer

gill arch partially joined to gill cover, as usual. Gill-rakers obsolete. Gill membranes united, forming a wide free fold across isthmus posteriorly.

Scales without ridges, their exposed surfaces thickly beset with spines, which are usually without definite arrangement. The marginal spines are the longest, thence decreasing in length to the base; about forty present on each scale on middle of sides. The scales on head are crowded, the spines are shorter and not directed backwards as on the body. A rosette of short spines on tip of snout. No naked area between ventrals. Mandible and gill membranes partly scaled. No considerable naked area in axil of pectorals.

Dorsal inserted over base of pectorals, the length of its base slightly less than half the interspace between base of dorsals. Second dorsal spine rather short and fragile, furnished anteriorly with a series of retrorse spinules. Its length slightly exceeds half that of head, its tip not reaching origin of second dorsal.

Origin of anal fin well in advance of second dorsal; the vent is unusually far forwards, its distance from base of ventrals two to two and one-half times in its distance from anal fin.

Ventrals less widely separated than in *M. scaphopsis*, the outer ray produced, extending beyond front of anal. Ventrals with ten rays. Pectorals with twenty-two to twenty-four rays. Longest pectoral ray equals half head.

Color: Very dark brownish, lighter on tail; lower side of head, breast, and abdominal region, including front of anal and base of pectorals, blue-black. Roof of mouth, valvular flap of membrane behind bands of teeth, gill membranes, and upper posterior portion of opercular lining, black; mouth and gill cavity otherwise white. Peritoneum bright silvery, with little black specking. Fins dusky.

Two specimens, the longest 12 inches in length, from Station 2960, in 267 fathoms.

83. *Macrurus* (*Lionurus*) *liolepis* sp. nov.

Head $4\frac{2}{3}$ in length; depth $6\frac{1}{2}$. D. II, 10; A. 120. L. 10 inches.

Snout short and high, with well marked lateral ridge, the extreme tip flattened; the median ethmoidal ridge is prominent, and the supra-ocular ridge is continued forwards on the snout, meeting the lateral ridge in a projecting point. Top of snout wholly naked mesially, a narrow band of scales around each margin and in front. Lower side of head including under side of snout, mandibles, gill membranes, and most of interopercles naked; a very small patch of scales on posterior part of interopercle.

Mouth moderate, the snout overhanging the premaxillaries for a distance equaling one-half maxillary. Maxillary nearly reaching vertical from posterior margin of orbit, $2\frac{1}{2}$ in head; eye $3\frac{3}{4}$; interorbital space concave, equaling snout, $4\frac{1}{3}$. Barbel three-fifths eye.

Teeth in rather narrow cardiform bands in both jaws, not however forming single series laterally; the outer series in upper jaw only is enlarged. Angle of preopercle little produced, not concealing the interopercle; the infraorbital ridge not continued on to it. Gill membranes forming posteriorly a rather wide free fold across isthmus. Outer gill arch joined to gill cover as usual in this genus.

Scales small, everywhere cycloid, very deciduous, lost in most specimens. No spines are developed, but occasionally can be seen traces of a median ridge and a pair of lateral ridges. About six or seven series of scales between lateral line and base of first dorsal.

Origin of first dorsal over or in advance of the base of the pectorals. Base of first dorsal $1\frac{1}{3}$ to $1\frac{2}{3}$ in interval between dorsals. Second dorsal spine usually smooth, occasionally with from one to three weak prickles near the middle. Length of spine $1\frac{1}{2}$ in head.

Origin of anal slightly behind first dorsal, the vent midway between base of ventrals and anal. Ventrals short, the outer ray slightly produced, with from ten to twelve rays. Pectorals with twenty or twenty-one rays.

Color: Very dark brown; snout, opercles, lower side of head, and abdominal region, black or blue-black. Mouth and gill cavity black; peritoneum dusky silvery.

Station 2980, in 603 fathoms. Many specimens.

84. *Platophrys tæniopterus* sp. nov.

Differing from all known species in the ribbon-shaped prolongations of second dorsal ray and first and second ventral rays of eyed side, and in the obsolete lateral line of blind side.

Body elongate, the depth $2\frac{1}{2}$ in length, in specimens $3\frac{1}{2}$ inches long. Caudal fin subsessile, the last dorsal and anal rays inserted near rudimentary caudal rays; height of caudal peduncle one-quarter height of body. Upper profile descending very obliquely anteriorly, a slight re-entrant angle in front of lower eye; in males, the profile slightly angulated in front of upper orbit, below which it descends more steeply.

Lower eye much in advance of upper; in females, with eyes close together, the vertical from middle of lower eye passes through front of upper orbit. Diameter of upper orbit $3\frac{1}{2}$ in head. In males the lower eye may be entirely in advance of upper.

In females 3 inches long, and in very young males the interorbital space is a narrow, concave, scaleless groove, less than diameter of pupil, running into a deep pit behind lower eye. In males 2 inches long, the interorbital space has already widened, and in specimens $3\frac{1}{2}$ inches long is as wide as longitudinal diameter of orbit. It is traversed by an oblique ridge running upwards and backwards from front of lower eye, separating the anterior scaleless portion from the deep scaly pit behind. Supraorbital ridge of lower eye serrated, forming a strong

series of spines, less marked in females. Anterior rim of upper orbit similarly, but less strongly, marked. A strong double spine on maxillary, in front of nostrils. A spine near end of maxillary in males.

Mouth small, maxillary not reaching front of pupil, equaling diameter of orbit. Teeth small, in a single close-set series in each jaw, equally developed on both sides, with enlarged canines.

Gill-rakers very short and weak, eight on horizontal limb.

Anterior nostrils with very short flaps.

Dorsal beginning above front of lower eye. In all specimens, females as well as males, the first two rays are detached from the rest of fin, the second ray produced into a flat ribbon-shaped filament about as long as head. Dorsal and anal rays all unbranched. Median caudal rays forked. No anal spine.

Ventral of colored side on ridge of abdomen, the two anterior rays in males connected by membrane at base only, produced into flat filaments as long as head, extending far beyond front of anal.

Pectoral of left side well developed, but small, slightly more than half head; that of blind side little developed, about half diameter of orbit.

Scales of left side strongly ctenoid, absent on interorbital space, snout, maxillary and mandible; lateral line with strong curve anteriorly, the chord of which is contained five times in straight portion. Along lateral line are occasional broad cutaneous flaps, colored blue in life. Scales of blind side cycloid, the tubes of lateral line obsolete, the course of lateral line indistinctly indicated by pits at bases of scales, and occasional pore-like markings. Median rays of dorsal and anal on left side with series of ctenoid scales, otherwise scaleless. Caudal rays with double series on both sides.

Head $3\frac{2}{3}$; depth $2\frac{1}{2}$. Lat. l. 60-65, the arch with fifteen pores. D. 86-88; A. 67-70. Twenty scales in a series running upwards and backwards from lateral line. L. $3\frac{1}{2}$ inches in longest specimen.

Color: On left side olive-brown, with many small irregular spots of light gray, with darker borders. Three or four dark blotches along lateral line. Along dorsal and ventral outlines are about five pairs of light spots, broadly ocellated with blackish. Males with a bright blue spot on anterior profile, at base of each of first ten or twelve dorsal rays, and one on end of snout.

Blind side in males with a broad oblique bar covering about one-fourth of sides, bluish-black in life, dark brown in spirits. From its upper anterior part a number of narrow parallel streaks run forwards towards head, much as in *Engyophrys sancti-laurentii*. Filamentous rays of dorsal and ventral white. Fins all speckled; a small black spot at base of median caudal rays.

Several specimens from Station 2998, in 40 fathoms.

85. *Citharichthys xanthostigma* sp. nov.

D. 81-86; A. 63-67. Lat. l. 50. Vertebrae, 11+26.

In external appearance most closely resembling *C. sordidus*, to which, however, it is not closely related, differing in number of scales, fin rays, and vertebrae, and in the size and number of gill-rakers.

Body deep, varying from $2\frac{1}{3}$ (in young, 3 inches long) to $2\frac{1}{10}$ (7 inches long) in length of body. Profile angulated above front of upper eye, the snout convexly projecting. Depth of caudal peduncle one-third head. Lower eye in advance, the vertical from front of the upper passing through front of lower pupil.

Mouth rather small, the outline somewhat curved, the maxillary reaching the vertical from front of lower pupil, 3 to $3\frac{1}{4}$ in head; mandible with a sharp downward-directed point at symphysis. Teeth in a single close-set series in each jaw, growing slightly larger anteriorly, but without canines. Anterior nostril with a short tube, and a narrow flap arising from its inner edge. Interorbital width $3\frac{3}{4}$ to 5 in orbit, slightly concave, the lower ridge much stronger and higher than the upper; scaled posteriorly. Eye large, the upper orbit $3\frac{1}{3}$ to $3\frac{2}{3}$ in head. Gill-rakers rather long and slender, coarsely dentate on inner margin, distant, ten or eleven on anterior limb of arch.

Scales large, in regular series, appearing cycloid, but the edges very minutely spinous. Lateral line gently rising on anterior third, but without curve. Fifty vertical series of scales, with as many pores in lateral line; 13 to 15 horizontal series above lateral line.

Dorsal beginning immediately behind posterior nostril of blind side, ending so as to leave caudal peduncle free for a distance equaling one-half diameter of eye.

Ventrals long, reaching beyond origin of anal.

Pectorals very long and slender, normally with nine rays, the longest ray on colored side longer than head, about one-third length of body.

Color: Light olive-brown, irregularly flecked with slaty, and with numerous bright yellow spots broadly ocellated with brownish-black: a series of these usually on lateral line, and two others half-way between it and the dorsal and ventral outlines respectively, those of the latter series forming pairs. Fins not conspicuously marked, the pectorals sometimes with faint broad dusky cross-bars.

Many specimens, from Stations 3039, 3043, and 3044, Magdalena Bay, in 47 to 74 fathoms.

86. *Citharichthys fragilis* sp. nov.

D. 83-87; A. 67-70. Lat. l. 46-50. Vertebrae 10 + 27.

Closely related to *C. sordidus*, from which it differs in the fewer vertebrae and fin rays and the larger scales. The body is elongate, posteriorly sharply wedge-shaped, tapering to base of caudal. Anterior profile very conspicuously angulated above front of upper eye, the snout

strongly projecting, its anterior profile nearly vertical. Depth, $2\frac{3}{8}$ to $2\frac{3}{4}$ in length in specimens 5 inches long. Depth of caudal peduncle, $2\frac{7}{8}$ in head.

Head, $3\frac{2}{5}$ to $3\frac{3}{5}$ in length. Anterior nostril with a short tube and flap, the latter nearly obsolete on blind side. Mouth more oblique than in *sordidus*; maxillary reaching vertical from front of pupil, $2\frac{2}{5}$ to $2\frac{3}{5}$ in head. Teeth in a single series, close-set, those anteriorly somewhat enlarged, but none of them canine-like. Eyes large, the vertical from front margin of upper eye falling through front of lower pupil. Longest diameter of upper orbit $2\frac{2}{3}$ in head. Interorbital space narrow, concave, scaled, the lower ridge strongest, its width about one-eighth diameter of orbit. Symphyseal knob sharp. Gill-rakers long, slender, close-set (as in *sordidus*), eighteen on anterior limb of arch, the longest one-third orbit.

Scales large, deciduous, somewhat irregularly arranged, twelve or thirteen series above lateral line. Scales smooth on blind side, minutely spinous on eyed side. Lateral line without anterior arch.

Dorsal beginning slightly in advance of eye, the longest ray half head.

Pectorals long and narrow, with eleven rays on colored side.

Color, dusky-olivaceous, with occasional slaty-blue spots.

Many specimens from the Gulf of California, in from 18 to 76 fathoms. Stations 3011, 3016, 3017, 3018, and 3033.

87. *Ancylosetta dendritica* sp. nov.

Differing from *A. quadrocellata* in the branched tubes of the lateral line, the very broad short gill-rakers rough with teeth, etc.

Body very broad, its depth $1\frac{1}{3}$ in length, the two outlines equally curved; profile not very strongly angulated in front of upper eye. Lower eye slightly in advance of upper. Interorbital space a rather broad convex scaly ridge, about one-third upper eye, which is contained about five times in head and is equal to snout. A blunt spine on snout on head of maxillary. Nostril openings very broad, without tube, the anterior with a narrow flap. Mouth moderate, very oblique, the gape curved, maxillary reaching slightly beyond vertical from middle of lower eye, 3 in head. Teeth in a single rather close-set series in each jaw, strong, conical, directed very obliquely inward, becoming gradually larger towards front of jaw, but not canine-like. Gill-rakers very short, barely movable, as broad as long, strongly toothed, six on anterior limb.

Dorsal beginning over middle of upper eye, the anterior rays partly free toward tips, but little, if any, elevated above those that follow, the first $3\frac{2}{3}$ in head. Dorsal highest in its posterior third, the longest ray $2\frac{2}{5}$ in head. Anal similar, the rays of posterior third of both fins slightly forked at tips. Caudal peduncle deep and short, its depth about half head, its length half its depth. Caudal rounded, almost double truncate.

Ventrals with narrow bases, the left one slightly in advance of the right; the fin greatly produced, reaching far beyond front of anal, a trifle shorter than head. Left pectoral $1\frac{3}{5}$ in head.

Scales very strongly ctenoid, the edge spinous, the entire exposed portion rough. Width of anterior arch of lateral line $3\frac{1}{2}$ in straight portion. Tubes of lateral line borne by a series of smaller concealed cycloid scales, the free edges of which are notched to the opening of the pore. These scales are entirely covered by the integument, and from the pores there proceed backward membranous tubes, ramifying over the bases of contiguous scales. This is true also of lateral line of blind side. Eyed side entirely scaled except snout and mandible.

Head $3\frac{5}{8}$ in length; depth $1\frac{2}{3}$. D. 84; A. 63. Lat. l. 100; 36 scales in a series upward and backward from lat. l.

Vertical fins covered with thick skin, each ray accompanied with one or two series of ctenoid scales. Left ventral also scaled.

Color, olive-brown, with three large black ocellated spots larger than orbit, the posterior one on lateral line in front of caudal peduncle, the two anterior under middle of dorsal, half-way between lateral line and dorsal and anal outlines, respectively; each spot with a light center. Distal portion of vertical fins more or less brown on right side.

A single specimen, 13 inches long, from station 3022, in 11 fathoms.

88. *Hippoglossina bollmani* sp. nov.

Hippoglossina macrops Jordan and Bollman, Proc. U. S. Nat. Mus., 1889, 175 (not of Steindachner*). Station 2805.

Differing from *H. stomata* Eigenmann in the gill-rakers, which are shorter and much fewer in number, and in the larger scales on sides.

Scales in sixteen rows between lateral line and back, instead of twenty-one or twenty-two as in *stomata*.

Gill rakers somewhat shorter, eight or nine on anterior limb, two on upper limb. In *H. macrops* the gill-rakers are slender, close-set, thirteen or fourteen on anterior limb, four on vertical limb.

In other respects of color, fin-rays, and squamation agreeing perfectly with *H. stomata*.

Lioglossina gen. nov. (*Pleuronectidae*).

This genus differs from *Hippoglossina* in the cycloid scales only, and from *Xystreurus* in the uniform fine teeth.

Type, *Lioglossina tetrophthalmus* sp. nov.

89. *Lioglossina tetrophthalmus* sp. nov.

Body of moderate height, the profile distinctly angulated above upper pupil, the snout projecting; length of caudal peduncle one-half its depth, its outlines diverging backwards. Depth of body $2\frac{1}{3}$ in

**Hippoglossina macrops* Steindachner is nearer *H. stomata* than *H. bollmani*, but apparently differs in the deeper body and smaller mouth. Its gill-rakers are not described.

length. Head large, $3\frac{1}{4}$ in length, in a specimen 1 foot long. Snout projecting beyond profile, bluntly rounded, the lower jaw included.

Mouth large, the maxillary reaching nearly to vertical from posterior border of lower eye, $2\frac{1}{3}$ in head. A blunt projecting process anteriorly from head of maxillary. Teeth small, pointed, in a single close-set series in each jaw, none of them enlarged. Vomer toothless. Lower eye slightly in advance of upper; vertical from front of upper, falling midway between front of orbit and front of pupil of lower eye. Vertical diameter of upper orbit but little more than one-half its longitudinal diameter, which is contained $3\frac{1}{2}$ in head. Interorbital space a blunt high ridge, entirely scaleless, its width two-fifths diameter of orbit. Anterior nostril of blind side with a very long flap, that of eyed side shorter. A well-marked cutaneous flap on lower eye above pupil.

Gill rakers very large, broad, and strong, well toothed on inner edges; the longest equals diameter of pupil; number on outer gill arch ten or eleven.

First dorsal ray over anterior margin of upper pupil, the fin not high, its highest ray 3 in head. Anal similar. Caudal sharply double truncate, the median rays produced. Ventrals rounded, equal, barely reaching front of anal. No spine before anal fin. Pectorals moderate, with nine or ten developed rays, half length of head. V. 6.

Scales rather small, growing distinctly larger posteriorly, everywhere smooth. Head scaled, except snout, interorbital area, mandible, and part of maxillary; the latter with a patch of scales on the posterior end of its expanded portion. On blind side an area around nostrils, and the greater part of the exposed portion of preorbital, scaleless. Fin rays of vertical fins, all with bands of fine scales, those on caudal especially broad. Lateral line with a broad arch in front, the chord of which is $3\frac{2}{3}$ in straight portion.

D. 76 to 83; A. 58 to 62. Lat. 1. (pores) 97. L. 12 inches.

Color: Dusky-brownish, with two conspicuous pairs of round black spots narrowly edged with gray, the anterior pair about half size of orbit, the posterior larger than pupil; the anterior pair are under beginning of posterior third of dorsal, and are about half way between lateral line and dorsal and anal margins, respectively; the posterior pair are nearer outlines of body, and are about under the tenth before the last dorsal ray. Vertical fins obscurely blotched with darker. Ventral of eyed side with a conspicuous black blotch margined with white, occupying the distal portion of its inner two rays. Pectoral unmarked. Membrane of gill cavity and peritoneum white.

Two specimens, about 12 inches long, from the Gulf of California, taken in 29 and 76 fathoms. Stations 3014 and 3016.

90. *Cynicoglossus bathybius* sp. nov.

A well marked species differing from its congeners in its much greater depth and bright coloration, and in having the teeth well developed on both sides of jaws, as in the species of *Glyptocephalus*.

D. 111-117; A. 96-98. Vertebrae 14+49.

Body oval, very deep and thin, the greatest depth at anterior third of body; upper profile very abruptly angulated opposite hinder margin of upper pupil, the anterior half of head conspicuously protruding beyond general outline. Caudal nearly sessile, the peduncle very short.

Mouth small, maxillary about one-fifth length of head in specimens 1 foot long. Teeth broad incisors, slightly notched at tip, nearly equally developed on blind and colored sides, twenty-one on blind side of lower jaw, sixteen on colored side. As in other members of this group, the lower jaw is the longer, the upper teeth included,

Interorbital space wholly scaled, with a very high, rather sharp ~ shaped ridge.

Eyes very large, the upper entering largely the upper profile, the lower much in advance; front margin of upper orbit on vertical of front of lower pupil; diameter of upper eye $2\frac{3}{4}$ to $2\frac{4}{5}$ in head.

Anterior nostrils of both sides in rather long tubes, the posterior margins of which are produced to form short flaps.

Preopercular margins adnate as usual, concealed by scales. No conspicuous mucous excavations on blind side.

Gill rakers weak and rather short, ten or eleven on anterior limb of arch.

Scales very small, cycloid, in about one hundred and sixty-five cross-rows, the tubes of lateral line much fewer, not regularly arranged. Over fifty longitudinal rows above lateral line.

Dorsal beginning over posterior edge of pupil. Fins low, the highest dorsal rays behind middle of body, two-fifths length of head.

Caudal rounded, two-thirds length of head. Pectorals one-half head.

Ventrals small, each with five rays, as in *C. pacificus*, the number being probably characteristic for the genus. *Glyptocephalus cynoglossus* and *zachirus* have six rays in each ventral.

Head 4 to $4\frac{2}{5}$ in length; depth 2 to $2\frac{1}{3}$.

Color of eyed side warm brown, darker toward margins, becoming black on vertical fins; everywhere on body and fins coarsely blotched with light blue, the marks so arranged on upper and lower thirds of sides as to form five broad bars of bluish, alternating with those of the ground color, and corresponding above and below. Lips and branchiostegal membranes black. Blind side dusky brownish.

Two specimens from the Santa Barbara Channel, taken at a depth of 603 fathoms. Station 2980.

91. *Halieutæa spongiosa* sp. nov.

This species is remarkable for the soft, spongy texture of the body, and the membranous or cartilaginous character of its bones.

Width of head $1\frac{1}{2}$ in its length. Tail long and slender, the vent midway between base of caudal and articulation of mandible. Width of base of tail $4\frac{1}{3}$ in its length. Mouth little or not at all overpassed

by the snout, its width $2\frac{3}{4}$ to 3 in that of head, lower jaw usually not included; gape of mouth oblique, almost wholly anterior. Teeth in wide cardiform bands in the jaws, none of them enlarged. Palate toothless. Interorbital width slightly greater than length of snout, 5 in width of head. Eye $1\frac{3}{4}$ in interorbital width.

Rostral tentacle short, with an expanded three-lobed tip. Front of dorsal midway between base of caudal and occiput. Caudal long, rounded, the lower rays more shortened than the upper, the longest nearly half width of head. Anal rays high, closely bound together, the fin slender, shaped like the intromittent organ of *Gambusia*; the length of its base equals two-thirds diameter of orbit; its longest ray reaches base of caudal. Pectorals long, the posterior ray rapidly shortened, the longest one-half width of head.

Head and body everywhere with broadly conical, tubercular plates, varying in size, marked with strong lines, radiating from the center. The apex is sometimes blunt, more often provided with a slender spine, sometimes bifid or trifid; on the tail these spines become longer and are directed backwards. The plates along edge of disk are not compressed nor specially modified.

A deep groove-like channel just behind mandible and following curve of latter, becoming continuous with another deeper channel running just below edge of disk to near base of pectorals. A third groove runs backwards from nostrils, uniting with the others. These grooves are spanned at intervals by pairs of fleshy tentacles with fringed tips, which spring from the edges of the grooves and meet across them. At the bottom of the grooves under each pair of tentacles is a small fleshy tubercle. Fin rays, at least at base, with series of small curved prickles. D. 6; A. 4; C. 9; V. 4; P. 12 or 13.

Color: Uniform dusky, the tail sometimes lighter; fins blackish, more or less edged with white. One specimen with the body and tail uniformly light.

Numerous specimens, the largest $4\frac{1}{2}$ inches long from Station 2992, in 460 fathoms.

92. *Melichthys bispinosus* sp. nov.

Agreeing perfectly with current descriptions of *M. piceus* and *M. ringens*, but having only two dorsal spines in all of our numerous specimens.

Lower jaw but little protruding in open mouth. Eight teeth in each jaw, the two anterior of which are broad truncate incisors without notch. The three lateral teeth in lower jaw are conspicuously notched, the anterior angle projecting; in the upper jaw the posterior tooth is truncate, entire, and the other two lateral teeth but slightly notched. Teeth in lower jaw with a strong horizontal backward process.

Head $3\frac{2}{3}$ in length; depth 2. Eye 5 in snout. Length of anteorbital groove two-thirds eye. Width of gill slit one-third snout.

Distance from end of dorsal groove to soft dorsal $2\frac{1}{2}$ in snout. First dorsal spine very heavy, its tip curved backwards, its length one half head; the front and sides of spine are rugose, but not spinous, the rugosities coarser in front and above. Second dorsal spine very slender, two-fifths height of first. No trace of a third spine, the membrane extending almost to posterior end of groove, the length of its base about one-half snout. Second dorsal and anal not falcate, the upper outline straight, the fins becoming uniformly lower posteriorly. Caudal fin slightly convex behind, the tips produced for a distance about equal to diameter of orbit.

Plates very rough, with broken ridges, radiating from base; they are essentially similar in shape on sides of body and head, showing no tendency to coalesce on cheeks. On posterior part of sides are eight raised lines formed of rough median crests on the plates, the crests not bearing distinct spines. Several enlarged plates immediately behind the opercle, each with centrally radiating lines.

Pelvic spine very rough, as well as the membrane immediately behind it.

D. II-32; A. 29. Fifty-two transverse series of plates between base of pectorals and base of caudal. Pectorals with fifteen rays.

Color: Very deep cobalt-blue in life, becoming uniformly black in spirits. A narrow light blue line along bases of dorsal and anal, becoming white in spirits. Caudal with an intramarginal black band, edged posteriorly with a very narrow white line.

This species was found very abundant at Clarion and Socorro Islands, and many specimens were secured.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COM-
MISSION STEAMER ALBATROSS.

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NO. XIII.—CATALOGUE OF SKELETONS OF BIRDS COLLECTED AT THE
ABROLHOS ISLANDS, BRAZIL, THE STRAITS OF MAGELLAN, AND THE
GALAPAGOS ISLANDS, IN 1887-'88:

BY

FREDERIC A. LUCAS,

Assistant Curator of the Department of Comparative Anatomy.

Besides the skeletons noted in the following list there is a large num-
ber of birds in alcohol, available for anatomical purposes.

Family PICIDÆ.

Campephilus magellanicus (KING).

Straits of Magellan. (18482.)

Family ARIDÆ.

Pyrhura smaragdina (GMEL.).

Sandy Point, Straits of Magellan, January 27. (18550.)

Family FALCONIDÆ.

Falco peregrinus (TUNST.).

Cerros Island, Lower California. (18477.)

Polyborus tharus (MOL.).

Straits of Magellan. (18478.)

Milvago chimango (VIEILL.).

Laredo Bay, Straits of Magellan, January 22. (18473, 18474.)

Family BUTEONIDÆ.

Buteo galapagoensis (GOULD).

Duncan Island, Galapagos Group, April 13. Three specimens. (18470,
18472, 18560.)

The species has not hitherto been recorded from this locality.

Geranoetus melanoleucus (VIEILL.).

Elizabeth Island, Straits of Magellan, January 20. (18471.)

Family PANDIONIDÆ.

Pandion haliaëtus (GMEL.).

Cerros Island, Lower California, May 5. (18543.)

Family ARDEIDÆ.

Nycticorax pauper (SCL. and SALV.).

James Island, Galapagos Group, April 11. (18501.)

Not hitherto recorded from this locality.

Butorides plumbeus (SUNDEV.).

James Island, Galapagos Group, April 11. (18559.)

Family PELECANIDÆ.

Pelecanus californicus (RIDGW.?)

Panama Bay, United States of Colombia, March 15. (18483.)

Family SULIDÆ.

Sula cyanops (SUNDEV.).

Abrolhos Island, Brazil, December 8. (18542.)

Sula gossi (RIDGW.).

Chatham Island, Galapagos Group, April 4. (18493.)

Family PHÆTHONTIDÆ.

Phaëthon æthereus (LINN.).

Abrolhos Island, two specimens. December 28. (18486, 18555.)

Family FREGATIDÆ.

Fregata aquila (LINN.).

Abrolhos Island, Brazil, December 28. (18485.)

Family PHALACROCORACIDÆ.

Phalacrocorax vigua (VIEILL.).

Phalacrocorax brasiliensis AUCT.

Port Otway, Patagonia, February 10. (18479.)

Mr. Ridgway* has expressed the opinion that the differences existing

* Proc. U. S. National Museum, Vol. XII, p. 138.

between *P. vigua* and *P. mexicanus* are at most subspecific, and this seems to be borne out by the osteology of the two birds.

The frontal region of *P. mexicanus* is wider than that of *P. vigua* in the specimens at hand, but this is very likely a case of individual variation, as cormorants are slightly variable in this as in other respects.

Urile magellanica (GMEL.).

Elizabeth Island, Straits of Magellan, two specimens, January 20. (18428, 18480.)

The skeleton of this bird shows it to be nearly related to *Urile urile*, although compared with that bird the skull is proportionately larger and the pterygoids much shorter, wider, and more S-shaped; the ridge of culmen is also wider.

The ilio-ischiatic foramen is narrower in *U. magellanica* than in *U. urile*; otherwise the pelvis of the two species are much alike.

Urile albiventer (LESS.).

Elizabeth Island, Straits of Magellan, two specimens, January 20. (18427, 18481.)

This bird is a near relative of *U. carunculata* (GM.), and the crania of the two species are upon their superior aspect indistinguishable.

On the ventral aspect the pterygoids of *U. carunculata* are seen to be much more slender, straight, and narrow than those of *albiventer*, as well as slightly longer.

The pterygoid bones appear to offer some very good specific characters, and in the species examined, with the exception of *P. vigua*, cormorants from the southern hemisphere have these bones shorter than do those from the north.

U. albiventer and *U. carunculata* may be immediately distinguished amid all other species examined by their slender, strongly ridged beaks, and large globose calvaria.

The occipital style of these two birds is short, and less definitely grooved than in other cormorants.

Family PHÆNICOPTERIDÆ.

Phœnicopterus ruber (LINN.).

Charles Island, Galapagos Group, April 8. (18494, 18495.)

Family ANATIDÆ.

Cloephaga magellanica (GMEL.).

Port Otway, Patagonia, February 10. (18552.)

Cloephaga antarctica (GMEL.).

Port Otway, Patagonia, February 10. (18554.)

Tachyeres cinereus (GEML.).

Latitude Cove, Patagonia, February 6. (18553.) Island Harbor, Patagonia, February 8. (18484.)

Both young specimens; apparently young of the year, as the cranial sutures are all open.

Spatula platalea (V.).

Elizabeth Island, Straits of Magellan, January 20. (18549.)

Family **HÆMATOPODIDÆ**.**Hæmatopus ater** (VIEILL.).

Elizabeth Island, Straits of Magellan, January 20. (18548.)

Hæmatopus luctuosus (GARN.).

Elizabeth Island, Straits of Magellan, January 20. (18547.)

Family **CHARADRIIDÆ**.**Belonopterus chilensis** (MOL.).

Elizabeth Island, Straits of Magellan, January 20. (18546.)

Family **SCOLOPACIDÆ**.**Gallinago paraguayæ** (VIEILL.).

Laredo Bay, Straits of Magellan, January 22. (18558.)

Family **LARIDÆ**.**Larus dominicanus** (LICHT.).

Elizabeth Island, Straits of Magellan, January 20. (18545.)

Larus fuliginosus (GOULD).

Chatham Island, Galapagos Group, April 4. (18500.)

Creagrus furcatus (NÉB.).

Chatham Island, Galapagos Group, April 4. (18492.)

This unique skeleton is from a young bird, probably a year old. There has been no time as yet to compare this skeleton carefully with other species, but it makes no marked departure from the larine type.

Family **DIOMEDEIDÆ**.**Diomedea oxulans** (LINN.).

An adult specimen. (18554).

Family **SPHENISCIDÆ**.**Spheniscus magellanicus** (FORST.).

Mayne Harbor, Patagonia, February 5. (18541.)

Probably a bird of the year, as the xiphoid border of the sternum is still cartilaginous and the cranial sutures open.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH
COMMISSION STEAMER ALBATROSS.

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NO. XIV.—BIRDS FROM THE COASTS OF WESTERN NORTH AMERICA
AND ADJACENT ISLANDS, COLLECTED IN 1888-'89, WITH DESCRIPTIONS
OF NEW SPECIES.

BY

CHAS. H. TOWNSEND,

Resident Naturalist of the Steamer Albatross.

During the cruise of the *Albatross* from San Francisco to the Gulf of California, in the winter of 1889, anchorages were made at many islands off Upper and Lower California. Although these calls were for the purpose of drawing seines along the beaches, or conducting other fishery investigations, valuable specimens of plants and land animals were usually secured. The islands at which collections were made are: San Clemente, San Nicolas, Santa Barbara, Santa Rosa, and Santa Cruz, off California, and Guadaloupe, Cerros, Clarion, Socorro, San Benedicte, Carmen, George, and Angel Guardia, off Lower California. Collections were also made at many places on the main-land. The naval officers attached to the vessel rendered valuable assistance to the naturalists in these gatherings, and the sailors when granted shore liberty and furnished with collecting outfits seldom failed to return well laden. Frequently more specimens were brought on board than the naturalists found time to preserve, as they were employed in caring for the fishes and other marine specimens yielded from the regular dredging and fishing operations.

The islands of the Santa Barbara group have hitherto been very imperfectly explored with regard to their fauna. Clarion and San Benedicte Islands, of the Revillagigedo group, had never before been visited by naturalists. Socorro, an island of the same group, and one abounding in peculiar species of vertebrates, had not been visited since the type specimens were collected by Grayson, about the year 1870. The flora of all the Revillagigedo Islands is practically unknown, as the *Albatross* brought back only a small collection of flowering plants.

A rich field awaits the naturalist who can explore these islands carefully. A large snake inhabits Clarion Island, but I was unable to secure the single specimen I saw.

The nearer Revillagigedo Islands, San Benedicte and Socorro, lie about 100 miles southwest of the end of the peninsula of Lower California, Clarion being nearly 100 miles west of these. Clarion Island is about 6 miles long by 3 in average breadth. The central portion is a plateau about 1,000 feet high, with a few elevations perhaps 500 feet higher. It is mostly overgrown with long grass, head high, through which the pedestrian flounders helplessly; the slopes of the lesser elevations are clearer, with scattered bushes and low, scrubby trees. I was not able to reach the plateau until after two hours of laborious struggle through the wilderness of cactus that covers its southern slopes, cutting nearly every yard of the way with a sharp *machete*. No other members of the party attempted it. Cactus renders all the lower portions of the island practically impassable. The island is probably without fresh water, although a small lagoon near the south beach contained slightly brackish water at the time of our visit there in March. Southerly gales would probably drive sea water into the lagoon and for a time at least render this wretched supply entirely worthless.

Socorro Island is more than twice as large as Clarion and vastly more rugged and mountainous, having elevations of perhaps 5,000 feet. The greater portion of the island is covered with brush growing among rough volcanic rocks, two hills at the southwest end only being smooth and grassy. No permanent water holes were noticed in the vicinity of Braithwaite Bay, where the *Albatross* anchored.

San Benedicte Island is smaller than the others, being 3 or 4 miles long by 1 wide, with elevations of 500 feet or more. No cactus was observed on San Benedicte, and no woody bushes of any kind, but it is covered with a tangle of tall grass that is almost impenetrable. It is apparently without fresh water.

The Revillagigedo Islands are surpassed in volcanic roughness only by Angel Guardia Island in the Gulf of California. A singularly inappropriate application of names by their discoverers is noticeable. That distress must have been great indeed that could have found relief upon arid Socorro—*succor*; and at Puerto Refugio, Isla de la Ángel Guardia, we found ourselves upon the borders of a great waterless desert, where we were in constant danger of treading upon huge rattlesnakes, whose repulsiveness was rather emphasized by the abundance of a large iguana-like lizard (*Sauromalus*—bad reptile), a veritable dragon in appearance. A port of refuge and a guardian angel's habitation, indeed! Spanish sarcasm, I doubt not, in both cases.

It is proposed to supplement the somewhat concise diagnoses of new species in this paper by more complete descriptions at another time.

Five new species and six new subspecies are here described. The entire collection numbers 226 specimens, representing 92 species and subspecies.

The localities are mentioned in the order in which they were visited.

I. CLARION ISLAND.

Speotyto rostrata sp. nov.

Clarion Island Burrowing Owl.

SP. CHAR.—*Adult male*: Readily distinguished from *S. cucularia hypogea* by its larger and more elongated beak, larger feet, shorter wings and tail, barred markings on tail much narrower, markings on top of head less distinct. Wing, 6.40; tail, 2.90; culmen, .65; tarsus, 1.90.

Type, No. 117531, ♂, U. S. Nat. Mus. Clarion Island, off Lower California, March 4, 1889. C. H. Townsend.

Common; five specimens obtained.

Zenaidura clarionensis sp. nov.

SP. CHAR.—*Adult male*: Resembles *Z. macroura*, but has larger bill and feet, shorter wings and tail, vinaceous colors of under parts more intense and extending farther back, dark spot below auriculars smaller and less conspicuous, upper parts less spotted with black. Wing, 5.45; tail, 4.86; culmen, .65; tarsus, .90.

Type, No. 117525, ♂, U. S. Nat. Mus. Clarion Island, March 4, 1889. C. H. Townsend.

Abundant among the bushes on the higher parts of the island, but not easily obtained on account of the extensive tracts of cactus which effectually bar one's progress in every direction. We found it almost impossible to move on Clarion Island without a "machete" or some other sword-like instrument to clear the way. Six specimens saved.

Troglodytes tanneri sp. nov.

SP. CHAR.—*Adult female*: Probably more nearly related to *T. insularis* from Socorro Island than any other species of the genus, but very distinct in its larger size and darker coloration. Wings much larger, feet larger, bill slightly heavier, upper parts rusty, below creamy or buffy. Wing, 2.25; tail, 1.85; culmen, .60; tarsus, .80.

Type, No. 117515, ♀, U. S. Nat. Mus. Clarion Island, March 4, 1889. C. H. Townsend.

This is the most abundant bird on the island. It is named for Lieut. Commander Z. L. Tanner, U. S. Navy, with whom, during various voyages of the *Albatross* to the West Indies, South America, and Alaska, I have sailed more than 50,000 miles. Ten specimens obtained.

Puffinus auricularis sp. nov.

SP. CHAR.—*Adult female*: Not unlike *P. opisthomelas* in general appearance. Bill and feet smaller; colors of upper parts darker, nearly black; black of head extending below eye to level of mouth; black of wing extending well over edge of wing to the under surface; sides of

neck mottled by the gradual blending of white and black. Wing, 8.75; tail, 3.15; culmen, 1.20; tarsus, 1.70.

Type, No. 117540, ♀, U. S. Nat. Mus. Clarion Island, March 4, 1889. C. H. Townsend.

More than twenty of these birds, attracted doubtless by the electric lights, came on board the *Albatross* during the night we anchored off Clarion Island. It is a common species about the islands of the Revillagigedo group. Five specimens.

Asio accipitrinus (PALL.).

One specimen, ♀, March 4; no others seen.

Heteractitis incanus (GMEL.).

Common; three specimens, March 4.

Himantopus mexicanus (MÜLL.).

One specimen, March 4; a large flock seen.

Fregata aquila (LINN.).

Large communities of these birds occupy the bushes and rocks in some parts of the island, and doubtless breed there. One specimen, March 4.

Sula, sp.

Two or three species of "booby" abound at Clarion Island and breed there, as we found many nests and young. No specimens were collected, but it is likely that the species are the same as those of San Benedicte Island, where we obtained *S. piscator*, *S. brewsteri*, and *S. cyanops*.

Corvus, sp.

Several crows or ravens were seen at Clarion Island, which I remember as apparently smaller than the ravens collected at San Benedicte Island. No specimens could be secured.

II. SOCORRO ISLAND.

Oceanodroma socorroensis sp. nov.

SP. CHAR.—*Adult male*: Similar to *O. homochroa*, but wings longer; tail shorter and less deeply forked; tarsus and toes shorter; *sides of rump whitish*; no white on under surface of wings.

Wing, 5.50; tail, 2.75, forked for .50; culmen, .55; tarsus and toes, .85.

Type, No. 117497, ♂, U. S. Nat. Mus. Socorro Island, March 8. C. H. Townsend.

Only one specimen of this petrel was secured and very few others were seen, but some of the hills of the western end of the island are literally honeycombed by the burrows of some creature, which I am constrained to believe is this bird. The most diligent search failed to re-

veal the presence of any small mammal, while feathers of petrels were found about the burrows, which seemed of the proper size for this species. The small lizards of the island could not have excavated burrows of such a nature. If this theory should prove the correct one, I predict that the number of petrels to be seen at Socorro Island when visited at the proper breeding season will be something hitherto unheard of.

Mimodes graysoni (BAIRD).

Common; five specimens, March 8.

Pipilo carmani (LAWR.).

Common; three specimens, March 8.

Columbigallina passerina socorroensis (RIDGW.).

Common; five specimens, March 8.

Compsothlypis graysoni (RIDGW.).

Common; three specimens, March 8.

Troglodytes insularis (BAIRD).

Common; four specimens, March 8.

Buteo borealis socorroensis (RIDGW.).

Two specimens; March 8; only four or five seen.

Nycticorax violaceus (LINN.).

Rare; one specimen.

Zenaidura graysoni (LAWR.).

One specimen; no others seen.

The adult plumage of this species is here described for the first time, the original descriptions being from young birds collected by Colonel Grayson about twenty years ago, since which time no collector has visited the island.

Adult female: Upper parts, except head, olive-brown with a rusty wash; scapulars with a pair of large oval black spots near the end of each feather upon the outer margin of the webs, making more than a dozen spots in all; hind head, sides, and under surface of wings leaden blue. Forehead, sides of head, and entire under parts dark cinnamon. Bill black. Feet and legs red. Wing, 5.80; tail, 4.80; culmen, .60; tarsus, .1.

Type, No. 117498, U. S. Nat. Mus. Socorro Island, March 8, 1889. C. H. Townsend.

III. SAN BENEDICTE ISLAND.

Salpinctes obsoletus (SAY).

Abundant. This bird and the raven are the only resident land birds. Five specimens, March 10.

Corvus corax sinuatus (WAGL.).

Abundant and very familiar; three specimens, March 10.

Fregata aquila (LINN.).

Numerous; one specimen, March 10.

Sula piscator (LINN.).

Three specimens, March 10.

Sula brewsteri Goss.

One specimen, March 10.

Sula cyanops (SUND.).

One specimen, March 10.

These three specimens of *Sula* are rather numerous at San Benedicto Island.

IV. LOWER CALIFORNIA.

Amphispiza belli cinerea subsp. nov.

SUBSP. CHAR.—*Adult male*: Resembles *A. belli nevadensis* in lightness of coloration, but is much smaller, paler, and less streaked, being without the dark streaks on the back, and having the markings of throat and breast diminished. Wing, 2.25; tail, 2.55; culmen, .35; tarsus, .75.

Type, No. 117575, ♂, U. S. Nat. Mus. Ballaenas Bay, Lower California, May, 1888. C. H. Townsend.

Two specimens; others apparently similar were seen.

Calamospiza melanocorys (STEJN.).

One specimen, May, Ballaenas Bay, Lower California.

Ægialitis nivosa (CASS.).

One specimen.

Callipepla californica vallicola (RIDGW.).

Four specimens, Cape St. Lucas, April 7.

Harporhynchus cinereus XANTUS.

Two specimens, Cape St. Lucas, April 7.

Campylorhynchus affinis XANTUS.

Two specimens, Cape St. Lucas, April 7.

Auriparus flaviceps (SUND.).

Two specimens, Cape St. Lucas, April 7. One specimen, Concepcion Bay, March 19.

Polioptila plumbea BAIRD.

Two specimens, Cape St. Lucas, April 7. One specimen. La Paz, March 14. One specimen, Concepcion Bay, March 19.

Melanerpes uropygialis (BAIRD).

One specimen, Cape St. Lucas, April 7. One specimen, La Paz, March 14.

Dryobates scalaris lucasanus (XANTUS).

One specimen, Cape St. Lucas, April 7.

Columbigallina passerina pallescens (BAIRD).

One specimen, Cape St. Lucas, April 7.

Carpodacus frontalis ruberrimus (RIDGW.).

One specimen, Cape St. Lucas, April 7.

Helminthophila celata lutescens (RIDGW.).

One specimen, Cape St. Lucas, April 7.

Empidonax cineritius BREWST.

One specimen, Cape St. Lucas, April 7.

Chondestes grammacus strigatus (SWAINS.).

One specimen, Cape St. Lucas, April 7.

Amphispiza bilineata (CASS.).

One specimen, Carmen Island, Gulf of California, March 18.

Pipilo fuscus albigula (BAIRD).

One specimen, La Paz, March 14.

Sterna elegans GAME.

One specimen, La Paz, March 14.

Larus heermani CASS.

One specimen, Cousag Rock.

Larus philadelphia ORD.

One specimen, La Paz, March 14; Upper Gulf of California, March 27.

Larus occidentalis AUD.

One specimen, Georges Island, Gulf of California, March 25.

Sula brewsteri Goss.

Two specimens, Georges Island, Gulf of California. This species breeds here in abundance.

Hæmatopus frazari BREWST.

One specimen, Concepcion Bay, March 19.

V. NEAR MOUTH OF RIO COLORADO, SONORA.

Otocoris alpestris pallida subsp. nov.

SUBSP. CHAR.—*Adult male*: Palest of all the horned larks. The usual ruddiness of hind neck and rump much bleached out and blended with the coloration of the back in the paleness which suffuses the entire upper parts. Wing, 4.00; tail, 2.75.

Type, No. 117679, ♂, U. S. Nat. Mus. Near mouth of Rio Colorado, Sonora, March 26. C. H. Townsend. One specimen.

Lanius ludovicianus excubitorides (SWAINS.).

One specimen, March 26.

Spizella breweri (CASS.).

One specimen, March 26.

VI. CERROS ISLAND.

Thryothorus bewicki bairdi (SALV. and GODM.).

One specimen, May 5, 1888.

Amphispiza bilineata (CASS.).

One specimen, May 5, 1888.

VII. GUADALOUPE ISLAND, LOWER CALIFORNIA.

Salpinctes guadeloupensis RIDGW.

Six specimens, February 28.

Carpodacus amplus RIDGW.

Four specimens, February 28.

Junco insularis RIDGW.

Four specimens, February 28.

VIII. SANTA BARBARA ISLAND, CALIFORNIA.

Melospiza fasciata graminea subsp. nov.

SUBSP. CHAR.—*Adult male*: About the size of *Melospiza fasciata samuelis*, but with shorter tail and larger feet. Hind neck decidedly ashy; dark markings of back and sides of throat smaller and less blended; entire coloration lighter, giving an ashy appearance. Wing, 2.35; tail, 2.25; culmen, .40; tarsus, .80.

Type, No. 117634, ♂, U. S. Nat. Mus. Santa Barbara Island, February 13. C. H. Townsend.

Five specimens. This bird is extremely abundant on the small island of Santa Barbara, where it lives in the long coarse grass that grows thick and tangled everywhere, making walking difficult. From constant moving through the grass the plumage of this bird is always much worn. It is pre-eminently a dweller among grass.

Zonotrichia gambeli intermedia RIDGW.

One specimen, February 13.

Zonotrichia coronata (PALL.).

One specimen, February 13.

Carpodacus frontalis (SAY).

One specimen, February 13.

IX. SAN CLEMENTE ISLAND, CALIFORNIA.

Helminthophila celata sordida subsp. nov.

SUBSP. CHAR.—*Adult male*: Entire plumage decidedly darker than *H. celata lutescens*. Feet and bill larger; wings slightly shorter. There is an appearance of grayness about the upper plumage, owing to a leaden tinge on ends of feathers. Throat and under parts slightly streaked. Wing, 2.35; tail, 2.10; culmen, .45; tarsus, .70.

Type, No. 117606, ♂, U. S. Nat. Mus. San Clemente Island, January 25. C. H. Townsend.

One specimen. Occurs also on the islands of Santa Cruz and Santa Rosa.

Melospiza fasciata clementæ subsp. nov.

SUBSP. CHAR.—*Adult male*: Similar to *M. fasciata graminea* (Towns.), from Santa Barbara Island, but much larger, the bill being conspicuously longer (half an inch or more). Wing, 2.50; tail, 2.50; culmen, .45; tarsus, .85.

Type, No. 117620, ♂, U. S. Nat. Mus. San Clemente Island, January 25. C. H. Townsend.

Seven specimens. Found also on Santa Rosa Island.

Thryothorus bewickii bairdi (SALV. and GODM.).

Five specimens, January and May.

Amphispiza belli (CASS.).

Eight specimens, January 25, 1889, and May 8, 1888.

Pipilo maculatus megalonyx (BAIRD).

One specimen, January 25.

Carpodacus frontalis (SAY).

Four specimens, May 8, 1888, and January 25, 1889.

Otocoris alpestris insularis subsp. nov.

SUBSP. CHAR.—*Adult male*: In this bird the pallid and the ruddy colorations, characteristic of the western horned larks, are reduced to the minimum. It is much darker than *Otocoris alpestris chrysolaema*, with the light edging of the dark feathers of the back more sharply defined, and feathers of sides darker. Wing, 3.85; tail, 2.60; culmen, .45; tarsus, .85.

Type, No. 117674, U. S. Nat. Mus. San Clemente Island, January 25. C. H. Townsend.

Four specimens. This dark race inhabits the islands of San Nicolas, San Clemente, Santa Cruz, and Santa Rosa, and is very abundant. It was not found on the small island of Santa Barbara.

Speotyto cunicularia hypogæa (BONAP.).

Two specimens, January 25.

Ptychorhamphus aleuticus (PALL.).

One specimen, January 25.

X. SAN NICOLAS ISLAND, CALIFORNIA.

Otocoris alpestris insularis TOWNS.

Four specimens, January 25, 1889.

XI. SANTA ROSA ISLAND, CALIFORNIA.

Carpodacus frontalis (SAY).

Five specimens, January 7.

Melospiza fasciata clementæ TOWNS.

Four specimens, January 7.

Pipilo maculatus megalonyx (BAIRD).

Two specimens, January 7.

Helminthophila celata sordida TOWNS.

One specimen, January 7.

Otocoris alpestris insularis TOWNS.

One specimen, January 7.

XII. SANTA CRUZ ISLAND, CALIFORNIA.

Aphelocoma insularis HENSIL.

Seven specimens, February 6.

Pipilo maculatus megalonyx (BAIRD).

Two specimens, February 6.

Zonotrichia gambeli intermedia RIDGW.

Two specimens, February 6.

Zonotrichia coronata (PALL.).

One specimen, February 6.

Ammodramus sandwichensis alaudinus (BONAP.).

One specimen, February 6.

Helminthophila celata sordida TOWNS.

One specimen, February 7.

Thryothorus bewickii bairdi (SALV. and GODM.).

One specimen, February 7.

Salpinctes obsoletus (SAY).

Two specimens, February 7.

Vireo huttoni (CASS.).

One specimen, February 7.

Otocoris alpestris insularis TOWNS.

One specimen, February 7.

XIII. PROCELLARIIDÆ FROM VARIOUS LOCALITIES.

Halocyptena microsoma COUES.

One specimen. This is the second specimen of this species known. It flew on board the *Albatross* in Panama Bay, March, 1888, until which time the type specimen described in 1864 remained unique.

Puffinus tenebrosus PELZ.

Two specimens, Chatham Island, Galapagos, April 6, 1888.

Procellaria tethys BONAP.

Two specimens, near Equator, Pacific Ocean, March 1, 1888.

Cymodroma grallaria (VIEILL.).

Three specimens, 26° south latitude, Pacific Ocean, February 23, 1888.

Diomedea nigripes AUD.

One specimen, 80 miles off Cape Flattery, Washington, June, 1889.

Diomedea albatrus PALL.

Two specimens, 80 miles off Cape Flattery, Washington, June, 1889.

Fulmarus glacialis glupischa STEJN.

One specimen, off San Diego, California, January, 1889.

SCIENTIFIC RESULTS OF EXPLORATION BY THE U. S. FISH COM-
MISSION STEAMER ALBATROSS.

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No. XV.—REPTILES FROM CLARION AND SOCORRO ISLANDS AND THE GULF
OF CALIFORNIA, WITH DESCRIPTION OF A NEW SPECIES:

BY

CHAS. H. TOWNSEND,

Resident Naturalist of the Steamer Albatross.

The reptiles mentioned in this report were collected in 1888-'89 during the cruise of the steamer *Albatross* along the west coast of America and in the Gulf of California. The collection includes twelve species, one of which is new and here described.

CLARION ISLANDS.

***Uta clarionensis* sp. nov.**

Body with irregular dorsal and lateral black markings; limbs with transverse black bars on outer surfaces. Four dorsal ridges, consisting of single, strongly carinate scales, the middle pair separated by an irregular series of smaller simple scales. There is a shorter pair of dorso-lateral ridges of carinate scales, somewhat less regular. Tail more than twice the head and body; otherwise similar in size and proportions to *U. symmetrica*. Colors bluish, similar to *U. auriculata* from Socorro Island. Adult; under parts much lighter blue than upper; young, dusky above, whitish below. Five specimens, March 4, 1889. C. H. Townsend.

I saw a snake on Clarion Island which I was not able to capture.

SOCORRO ISLAND.

***Uta auriculata* COPE.**

Color bright blue, variegated with black markings on upper surface of body and limbs. Nine specimens, March 8, 1889.

LOWER CALIFORNIA.

Uta elegans YARROW.

One specimen, San Luis Gonzales Bay, March 27. One specimen, Carmen Island, Gulf of California, March 13. One specimen, San Bartolome Bay, April 11.

Callisaurus draconoides (DE BL.).

Six specimens, San Luis Gonzales Bay, March 27. One specimen near mouth of Rio Colorado.

Dipsosaurus dorsalis (B. and G.).

Four specimens, San Luis Gonzales Bay, March 27.

Phyllodactylus unctus COPE.

One specimen, La Paz, March 12.

Sceloporus rufidorsum YARROW.

One specimen, Cape St. Lucas, April 7.

ANGEL GUARDIA ISLAND, GULF OF CALIFORNIA.

Sauromalus ater DUMERIL.

Three specimens, March 29.

Callisaurus draconoides (DEBL.).

One specimen, March 29.

Crotalus pyrrhus COPE.

One specimen, March 29.

SAN CLEMENTE ISLAND, CALIFORNIA.

Uta stansburiana B. and G.

Two specimens, January 23.

SANTA CRUZ ISLAND, CALIFORNIA.

Uta stansburiana B. and G.

Nine specimens, February 7.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COM-
MISSION STEAMER ALBATROSS.

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No. XVI.—PLANTS COLLECTED IN 1889 AT SOCORRO AND CLARION
ISLANDS, PACIFIC OCEAN.

BY

DR. GEO. VASEY AND J. N. ROSE,
Botanist and Assistant Botanist, Department of Agriculture.

Among the various islands visited by the *Albatross* in her voyage along our Pacific coast in the year 1889 were Socorro and Clarion. A small and fragmentary collection was made from each of these islands. It is to be regretted that an arrangement had not been made for a large and careful collection, not only from these but from many other interesting points visited by this ship. We are indebted to Mr. Charles H. Townsend, the ornithologist of the expedition, for this collection, which he made in connection with his other work.

Socorro Island is the largest of the Revillagigedo group, and is about 260 miles south of Cape St. Lucas, Lower California, in latitude $18^{\circ} 43' 14''$ and longitude $110^{\circ} 54' 13''$. It is about 24 miles long by 9 miles broad. It contains a small mountain, which rises to the height of 2,000 feet. Clarion or Cloud lies to the south and west of Socorro, in latitude 18° and longitude $114^{\circ} 50'$.

The flora of these islands is doubtless tropical and similar to that of Mexico. The total number of species found on the two islands was twenty-six; eighteen are from Socorro and twelve from Clarion Island, four of which they have in common. One from Socorro has hitherto been found only in Southern Lower California. Three new species and variety are now described, one from Clarion, the others from Socorro. There are three species of Sapindaceæ from these islands, three Leguminosæ from Clarion Island, three Compositæ and two Gramineæ from Socorro, and two Euphorbiaceæ, one from each island.

These plants were collected in March, 1889.

PLANTS FROM CLARION ISLAND.

PORTULACACEÆ.

Portulaca pilosa L.

STERCULIACEÆ.

Waltheria Americana L.

ZYGOPHYLLACEÆ.

Tribulus cistoides L.

SAPINDACEÆ.

Dodonæa viscosa L.

Sapindus, sp.

LEGUMINOSÆ.

Erythrina, sp.

A single leaf of some Leguminous plant, similar to *E. crista-galli*, but the leaflet is obovate and obtuse.

Phaseolus, sp.

The whole plant cinereous, pubescent, leaflet, oval, entire; peduncle, 6 inches long; flower, purple. It resembles *P. atropurpureus* Moc. in some respects, but the leaves are dissimilar. It seems nearest No. 183 of Parry and Palmer (from Central Mexico, 1878), having similar leaves, petiole, and flowers, but the calyx lobes are more slender.

Sophora tomentosa L.

RUBIACEÆ.

Spermacoce, sp.

A single specimen obtained.

CONVOLVULACEÆ.

Ipomœa, sp.

Glabrous throughout: leaves three lobed, cordate at base; lobes obtuse to acute or even acuminate: peduncles long, five to six flowered: calyx with long acuminate lobes: corolla large (2 to 3 inches long), purple. The material of this species is poor and can not be properly identified. It does not match anything in the National Herbarium. The calyx and corolla is very similar to *I. insularis*, of Sandwich Islands, but the leaves are quite different.

LABIATÆ.

Teucrium Townsendii sp. nov.

Low and diffuse herb almost glabrous: lower leaves (1 inch long) oblong with cuneate-base, coarsely dentate: floral leaves (5 to 9 lines long) crowded, ovate, obtuse, entire: flowers solitary in the axils of

the leaves on pedicels 2 to 3 lines long: calyx 2 to 3 lines long, deeply five-lobed into ovate lanceolate divisions: corolla, lilac, 10 lines long, longer than the leaves, the lower lobes 5 lines broadly oval: seeds scarcely roughened, glabrous.

This species is very distinct from any North American representative of this genus. It resembles *T. laciniata* in its general habit, but its leaves are very different, all its floral leaves being entire and the lower ones merely dentate; the seed is also similar but smaller. *T. glandulosum* of Cedros Island has the floral leaves entire, but it is a taller form with a loose inflorescence, long pedicels and different seeds. We take pleasure in dedicating this species to the collector, Mr. Charles H. Townsend.

EUPHORBIACEÆ.

Euphorbia, sp.

PLANTS FROM SOCORRO ISLAND.

PORTULACACEÆ.

Portulaca pilosa L.

Only a single fruiting specimen.

STERCULIACEÆ.

Waltheria Americana L.

The inflorescence is unusually open and somewhat cymose.

ZYGOPHYLLACEÆ.

Tribulus cistoides L.

A very common plant on this island.

SAPINDACEÆ.

Cardiospermum Palmeri sp. nov..

Climbing over bushes; stems canescent-tomentose: leaves tomentose on both sides, biternate on petioles, half inch long; leaflets from 1 to 1½ inches long, sessile or on petiolule 3 to 4 lines long, ovate or oblong, coarsely dentate: peduncles 3 inches long: flowers rather large: the two outer sepals a half line long, broadly ovate, a little hirsute; the two inner, 2 lines long, oblong, glabrous; the two hypogynous glands short and rounded: petals white: capsule membranous, 12 to 18 lines in diameter, minutely hirsute to almost glabrous. C. H. Townsend, Socorro Island, March, 1889; Dr. Edward Palmer, La Paz, Lower California (No. 68), January 20, 1890.

Mr. Townsend got only a few capsules and a single leaf. Dr. Palmer's collection contains both flowers and fruit, and enables us to characterize this as a good species; this specimen has somewhat narrower

leaflets and more glabrous capsules, but in other respects is like the Socorro Island plant. Dr. Palmer says it is very rare in Lower California.

Two species were collected near Dr. Palmer's station by Xantus in 1859 and 1860. Neither of these was Dr. Gray able to definitely determine on account of poor material. One he refers to "*C. molle*, H. B. K.?", of which but a single specimen was collected. This we have not seen; it may possibly be the same species, but ours is certainly not *C. molle*. The other species of Xantus was referred to as "*Cardiospermum*, sp. nov." Mr. Watson thinks it may be *C. tortuosus*, although Dr. Gray was doubtful. (See Watson, Bibliographical Index, p. 79.) Bentham's plant was collected by Mr. Hind in 1837, from Magdalena Island, and Mr. Brandegee has collected it from the original station this past season. He did not find it at all on the main-land. Our plant is clearly not this species. *C. Halicacabum*, the only other species from the peninsula, is almost glabrous, with smaller flowers. Four or five other species occur in Mexico, but differ in hypogynous glands, foliage, etc.

The species to which it comes nearest is *C. Loxense*, H. B. K., from Peru, South America, but this has leaves with petiole $1\frac{1}{2}$ to 2 inches long, the outer sepal half the length of the inner, and with the capsule "pubescenti-hirtelles," etc.

Dr. Gray referred here, with some uncertainty, a plant from Wilkes's expedition, with perfectly glabrous capsules. Our plant resembles it, but has broader leaflets, longer peduncles, etc.

Dodonæa viscosa L.

RUBIACEÆ.

Spermacoce (Boneria), sp.

Species resembling *S. podocephala* Gray.

COMPOSITÆ.

Erigeron, sp.

Viguiera deltoidea Gray, var. *Townsendii*, var. nov.

Leaves entire and opposite: thinner and with less scabrosity than the type: rays five to eight.

Perityle Socorroensis Rose. Bot. Gaz., xv, 118. The type.

SOLANACEÆ.

Physalis glabra Benth. (?)

This may be a new species, but the material is insufficient and for the present it is referred to the above species. It is quite glabrous throughout: the largest leaves $1\frac{1}{2}$ inches long, cordate at base, obtuse at apex: corolla small (2 lines broad), with a large purple eye, anther bluish green.

ACANTHACEÆ.

Elytraria tridentata Vahl.

VERBENACEÆ.

Lantana involucrata L.

ARISTOLOCHIACEÆ.

Aristolochia brevipes Benth.

Probably this species, but material very scanty.

LORANTHACEÆ.

Phoradendron rubrum Griseb.

A single specimen sent without flower or fruit; the identification is uncertain; the leaves correspond very well with specimen in the National Herbarium.

EUPHORBIACEÆ.

Euphorbia, sp.

CYPERACEÆ.

Fimbristylis, sp.

GRAMINEÆ.

Cenchrus myosuroides H. B. K.

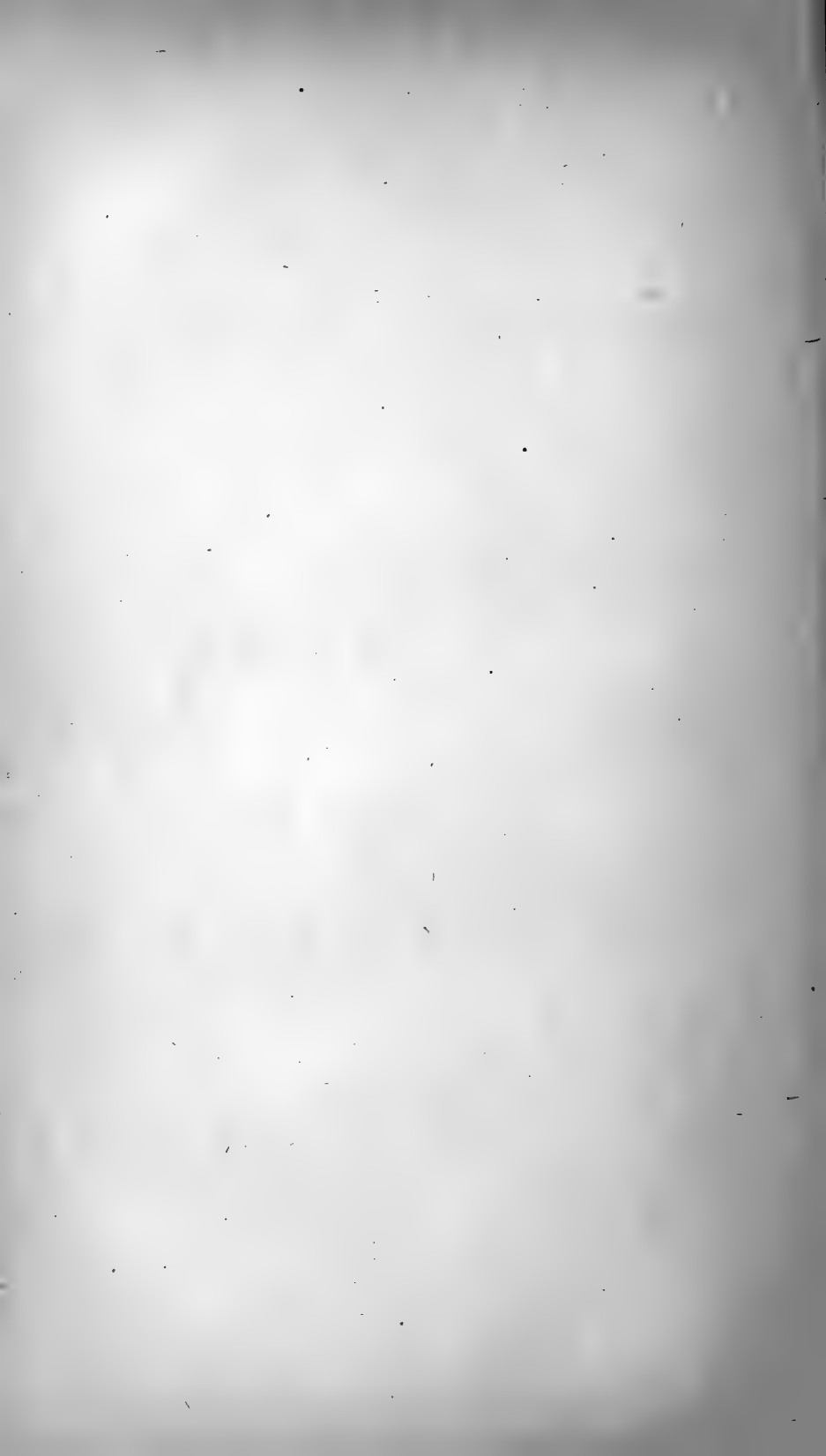
Heteropogon contortus R. & S.

FILICES.

Cheilanthes Wrightii Hook.

"Probably this species, but material too poor for exact determination." H. Seaton.

MARCH 5, 1889.



ON A NEW GENUS AND SPECIES OF COLUBRINE SNAKES FROM
NORTH AMERICA.

BY

LEONHARD STEJNEGER,

Curator of the Department of Reptiles and Batrachians.

The necessity of recognizing the two species treated of in this paper as forming a separate genus, and the discovery of one of them in southern Arizona, add another genus to the list of those peculiar to the Sonoran and the Lower Californian provinces. This genus is also a curious addition to those snakes peculiar to these zoological subdivisions, in which the rostral shows a most extraordinary development. In the present instance this shield resembles a thick leaf loosely attached to the front of the snout and turned over on top of the muzzle. The generic appellation here proposed has reference to this peculiarity, being derived from *φύλλον*, leaf, and *ρύγχος*, snout.

Phyllorhynchus, gen. nov.

DIAGNOSIS.—Head slightly distinct, short; tail short, less than one seventh of total length; palatine teeth present; dentition diacranterian; rostral plate greatly enlarged, with free lateral borders, and produced backwards so as to separate the supranasals entirely; anal undivided; no scale-pits; pupil vertical; nostril large; two nasals; loreal present; supralabials not in contact with orbit; one pair of genials only; 19 scale rows.

HABITAT.—Arizona and Lower California.

Type.—*Phyllorhynchus browni* STEJNEGER.

To this genus also belongs Cope's *Phimothyra* (or *Salvadora*) *decurtata*, which agrees with the above type in all essential characters. In all these, except the general shape of the rostral, it differs from *Salvadora* proper, the type of which is *S. grahamiæ*. In fact, while *Salvadora* seems to be correctly placed among the *Natricinæ*, *Phyllorhynchus* appears to be one of the *Coronellinæ*, as these subfamilies are defined by Professor Cope (Bull. U. S. Nat. Mus., No. 32, p. 51).

The most conspicuous characters which separate *Phyllorhynchus* from *Salvadora* may be tabulated as follows:

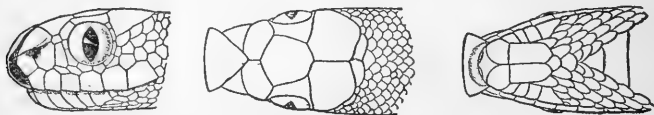
	<i>Phyllorhynchus</i> Steja.	<i>Salvadora</i> B. & G.
Anal.....	Entire.....	Divided.
Pupil.....	Vertical.....	Round.
Supralabials.....	Not entering orbit.....	Entering orbit.
Genaeals.....	One pair.....	Two pairs.
Rostral.....	Separating supranasals.....	Not separating supranasals.
Tail.....	Less than one-sixth of total length..	More than one-sixth of total length.
Head.....	Slightly distinct.....	Very distinct.
Scale rows.....	Nineteen.....	Seventeen.
Coloration.....	In blotches.....	In stripes.

Phyllorhynchus browni sp. nov.

DIAGNOSIS.—Scales distinctly keeled on the posterior two thirds of the body, in 19 rows; 4 loreals; labials $\frac{6}{9}$; gasterosteges 159; anal entire; urosteges 31, divided; tail about one-eighth of total length; upper surface with about 15 saddle-shaped brownish blotches on back and tail no lateral spots.

HABITAT.—Tucson, Arizona.

Type.—U. S. Nat. Mus., No. 15719; Herbert Brown coll.



♂ natural size.

Phyllorhynchus browni, U. S. Nat. Mus., No. 15719.

Description of type specimen.—Rostral very prominent and broad, recurved on the top of the snout so as to separate the supranasals entirely and the prefrontals partially, with free lateral edges which are rather sharp and thin; lower side of rostral deeply concave; two prefrontals; frontal large, hexagonal, as broad as long; parietals scarcely longer than frontal, their width equaling their length; at their posterior border a broad but very short shield with a median groove in continuation of the interparietal suture; nostril large, opening between the two large nasals and overhung by the prominent lower edge of the supranasal; the loreal proper high and narrow surmounted by a small supraloreal which joins the supranasal, the upper preorbitals, and the prefrontals, being a detached portion of the latter; between the loreal proper and the supralabials two small sublores; three preoculars, upper largest and not in contact with the frontal; two suboculars; four postoculars; three anterior temporals, upper largest; six supralabials, the two posterior largest (on the left side a narrow portion of the last is divided off anteriorly by a vertical suture not shown in the

figure), none in contact with orbit; nine infralabials, the first five largest; mental triangular, with two well-defined concavities on the anterior border; only one pair of large, broad genaeal shields, with a straight anterior border joined in its whole length by the posterior border of the first infralabials, the lower border of the second infralabial only meeting the lateral border of the genaeal; a small scale wedged in between the genaeal and the fourth and fifth infralabials probably represents the second pair of genaeals. Scales nearly equal, in 19 rows, those on the anterior third of the body nearly smooth, but becoming gradually more distinctly keeled posteriorly; gasterosteges 159; anal entire; urosteges 31 pairs. Tail rather blunt.

Dimensions.—Total length, 325^{mm}; length of tail from anus, 42^{mm}; proportion of tail to total length = 1:7.75.

Coloration (in alcohol).—White, with fifteen "seal brown"* blotches on the back from head to tip of tail, becoming paler posteriorly; the first of these blotches which begins three scale rows behind the parietals is of a uniform dark color, rather long and nearly hour-glass-shaped, its anterior border being concave, and the antero-lateral corners produced to the angle of the mouth, and nearly meeting the posterior ends of a broad line of dark color which runs from the upper posterior labials on one side through the eye across the interorbital space down to the hinder labials on the other side; the other blotches are more or less square with rounded corners, the middle portion being lighter—the dark color only "powdered" over the white ground—with dark borders. The anterior and posterior borders wider than the lateral ones, the white interspaces faintly "powdered" with brown on the sides; hinder supralabials with the posterior margin dark brown; lower surface uniform white.

This very distinct and interesting novelty with which I wish to associate the name of its discoverer, Mr. Herbert Brown, of Tucson, Ariz., in recognition of his successful researches in that Territory, differs in many important points from the previously described *Ph. decurtatus*, from Lower California. It is apparently of stouter build, with a proportionately longer tail; the dorsal scales are decidedly keeled on the posterior two-thirds of the body, while in *Ph. decurtatus* they are all smooth; the number of gasterosteges is larger and the urosteges fewer; in *Ph. decurtatus* the rostral seems to be thicker, and the shields on the sides of the face are fewer; finally, the coloration is very different, *Ph. browni* having only fifteen dorsal blotches and no lateral spots, against double the number of dorsal blotches and very pronounced lateral spots in *Ph. decurtatus*.

Through the courtesy of the authorities of the Philadelphia Academy of Natural Sciences I have before me the type of the latter species, and as the original description is meager and inadequate I take the opportunity to present a more detailed one.

*Ridgway, Nomencl. Colors, pl. iii, fig. 1.

Phyllorhynchus decurtatus (COPE).

- 1868.—*Phimothyra decurtata* COPE, Proc. Phila. Acad., 1868, p. 310.—*Id.*, Bull. U. S. Nat. Mus., No. 1, pp. 38, 92 (1875).—YARROW, Bull. U. S. Nat. Mus., No. 24, pp. 15, 99. (1885).
Salvadora decurtata GARMAN, N. Am. Serp., pp. 39, 145 (1883).—*Id.*, Bull. Essex Inst., xvi, p. —; List N. Am. Rept. Batr., p. 25 (1884).—COPE, Bull. U. S. Nat. Mus., No. 32, p. 72 (1887).—BOCOURT, Miss. Scientif. Mex., Rept., 11 livr., p. 663 (1888).

DIAGNOSIS.—Scales smooth throughout, in nineteen rows; 2–3 loreals; labials $\frac{6}{5}$; gasterosteges 172–177, anal entire; urosteges 26–27, divided; tail about $\frac{1}{11}$ of total length; upper surface with about thirty “amphicœlous” brown blotches on back and tail alternating with a more or less double series of smaller spots of same color on the sides.

HABITAT.—Lower California.

Type.—Mus. Phila. Acad. Nat. Sc.; Wm. M. Gabb coll.

Description of type specimen.—Rostral as in *Ph. browni*, but apparently thicker and not produced quite so far backwards, as its posterior apex only just touches the suture of the prefrontals; under side of free lateral border of rostral very distinctly folded transversely; two prefrontals; frontal hexagonal, longer than broad; parietals as long as frontal, and as long as broad; no shield behind parietals; nostril and nasals as in *Ph. browni*; loreal rather large, joining the prefrontal above, and meeting (on the right side) the second supralabial and a rather large subloreal below, which is wedged in between third and fourth supralabials, while on the left the upper portion of second supralabial is cut off so as to form a small second subloreal; three preoculars as in *Ph. browni*; two suboculars; three postoculars; two anterior temporals, on right side upper smallest, on left lower smallest; six supralabials, three posterior largest; infralabials and geneials as in *Ph. browni*; scales smooth, slightly decreasing in size towards the middle of the back, in 19 rows; gasterosteges 177; anal entire; urosteges 26 pairs.

Dimensions.—Total length, 350^{mm}; length of tail from anus, 29^{mm}; proportion of tail to total length = 1:12.

Coloration (in alcohol).—Ground color whitish, with about thirty-two “chocolate brown”* blotches on the back from neck to tip of tail; shape and size more or less irregular, but usually more or less concave in front and behind, pale in the middle, the brown color being merely sprinkled over the white ground; on the sides a row of smaller brown spots, two or three scales large, in a more or less double series, and, as a rule, alternating with the dorsal blotches; on the head a broad line from above each angle of the mouth running upward and forward through the eyes and meeting on the prefrontals; a few irregular spots on posterior portion of frontal, on parietals and anterior portion of neck, as well as on some of the supralabials; lower surface unspotted.

*Ridgway, Nomencl. Colors, pl. iii, fig. 4.

This specimen is said to have been collected "in the upper part" of Lower California. Another specimen is in the U. S. National Museum (12639), and was collected by Mr. L. Belding at La Paz, near the southern extremity of the peninsula.

This specimen agrees with the type in all essential points. The *scutellation* is identical with the right side of the type (one subloreal only) except that there are three anterior temporals, lower largest; gasterosteges 172; urosteges 27 pairs. The *dimensions* are: total length, 300^{mm}; tail from anus, 28^{mm}; proportion of tail to total length = 1:10.7. The coloration is also quite similar, the number of dorsal blotches being twenty-nine.

THE OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY ANGUILLIDÆ.

BY
THEODORE GILL, M. D., Ph. D.

The diversities within the restricted Apodes (or those anguilliform fishes without developed intermaxillaries and with the "vomer" projecting and forming, with the supramaxillaries, the upper arcade of the mouth) are very great, but were not appreciated till Professor Cope considered them in his "Observations on the Systematic Relations of the Fishes." * That great naturalist was so impressed by them that he distributed them under two orders, the *Enchelycephali*,† embracing the *Congridæ*, *Anguillidæ*, and *Murænesocidæ*, and the *Colocephali*,† including the *Murænidæ* and *Rataburidæ* (= *Moringuidæ*). While I am not prepared yet to admit the "orders" of Professor Cope, I retain the groups as suborders with modified characters, and the families appear not only to be justified, but, it seems to me, must be increased. A comparison of the skulls of *Anguilla*, *Conger*, *Murænesox*, *Simenchelys*, *Synaphobranchus*, *Ophichthys*, and *Muræna* has convinced me of the advisability of recognizing for each of them family rank. The characters of the family *Anguillidæ* contrasting with one or other of the other families are now given in the order which I have heretofore employed for full descriptions of families of normal fishes.

ANGUILLIDÆ.

Synonyms as family names.

- < *Pantoptères*, *Duméril*, Zool. Anal., pp. 111, 115, 1806.
- < *Anguillidi*, *Rafinesque*, Indice d'Ittiolog. Siciliana, p. 37, 1810.
- < *Pantopteria*, *Rafinesque*, Analyse de la Nature, 23 fam., p. —, 1815.
- < *Anguilliformes*, *Cuvier*, Règne Animal [1^e éd.], t. 2, p. 229, 1817; 2^e éd., t. 2, p. 348, 1829.
- < *Anguilloides*, *Latreille*, Fam. Nat., Règne An., p. 142, 1825.
- < *Les Murénides*, *Risso*, Hist. Nat. Europe mérid., t. 3, p. 189, 1826.
- < *Murænidæ*, *Bonaparte*, Giorn. Accad. di Scienze, v. 52 (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 34), 1832.
- < *Murænidæ*, *Bonaparte*, Nuovi Annali delle Sci. Nat., t. 2, p. 133, 1838; t. 4, p. 276, 1840.
- < *Murænidæ*, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 2, pp. 195, 333, 1839.
- < *Anguillares*, *Müller*, Archiv f. Naturgesch., 9. Jg., B. 1, p. 328, 1843.
- < *Murænidæ*, *Bonaparte*, Cat. Metod. Pesci Europei, p. 6*, 38*, 1846.
- < *Murænidæ*, *Adams*, Man. Nat. Hist., p. 110, 1854.

* Proc. Am. Ass. Adv. Science 1871, v. 20, pp. 317-343, 1872.

† *Op. cit.*, p. 334.

- = Anguillidæ, *Kaup*, Archiv f. Naturgesch., 22. Jg., B. 1, p. 54, 1856.
- = Anguillidæ, *Kaup*, Cat. Apod. Fish B. M., p. 32, 1856.
- = Anguillidæ, *Richardson*, Enc. Brit. 8th ed., v. 12, p. 232, 1856.
- = Anguilloidei, *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xxxiii, 1859.
- < Anguilloidei, *Kner*, Sitzungsber. k. Akad. Wissensch. (Wien), v. 42, p. 1, 1860.
- < Murænidae, *Günther*, Cat. Fishes Brit. Mus., v. 8, p. 19, 1870.
- = Anguillidæ, *Cope*, Proc. Am. Assoc. Adv. Sci., v. 20, p. 334, 1872.
- = Anguillidæ, *Gill*, Arrangement Fam. Fishes, p. 20, 1872.
- < Anguillæ, *Fitzinger*, Sitzungsber. k. Akad. der Wissensch. (Wien), B. 67, 1. Abth., p. 45, 1873.
- = Murænidi, *Poey*, Anal. Soc. Esp. Hist. Nat., v. 4, p. 10, 1875.
- < Anguillidæ, *Moreau*, Hist. Nat. Poiss. France, v. 3, p. 560, 1881.
- < Anguillidæ, *Jordan & Gilbert*, Syn. Fishes N. Am., p. 357, 1882.
- = Anguillidæ, *Gill*, Standard Nat. Hist., v. 3, p. 101, 1885.
- = Anguillidæ, *Jordan*, An. Rep. Com. Fish. for 1885, p. 843, 1887 (Sep., p. 55, 1885).
- = Anguillidæ, *Jordan*, Man. Vertebrates North. U. S., 5th ed., p. 89, 1888.

Synonyms as subfamily names.

- < Anguillina, *Rafinesque*, Analyse de la Nature, p. —, 1815.
- < Murænini, *Bonaparte*, Nuovi Annali d. Sci. Nat., t. 2, p. 133, 1838; t. 4, p. 276, 1840.
- < Anguillinae, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 1, p. 220, 1838.
- < Anguillini, *Bonaparte*, Cat. Metod. Pesci Europei, p. 6*, 38*, 1846.
- = Anguillinae, *Kaup*, Archiv f. Naturgesch., 22. Jg., B. 1, p. 54, 1856.
- < Anguillina, *Günther*, Cat. Fishes B. M., v. 8, pp. 20, 23, 1870.
- = Anguillinae, *Jordan & Gilbert*, Syn. Fishes N. A., p. 357, 1882.

DIAGNOSIS.

Enchelycephalous Apodals with conic head, well developed opercular apparatus, lateral maxillines, cardiform teeth, distinct tongue, vertical lateral branchial apertures, continuous vertical fins with the dorsal far from the head, pectorals well developed, scaly skin, and nearly perfect branchial skeleton.

Description.

Body typically anguilliform, anteriorly subcylindrical, compressed behind, robust and with the caudal portion gradually attenuated backwards, and with the anus in the anterior half of the length.

Scales small, linear or elongated elliptical, distant, arranged in small groups obliquely at right angles to those of the neighboring groups.

Lateral line distinct.

Head moderate, oblong conic, with all the bones invested in the muscles or skins.

Eyes within the anterior half of the head, directed sideways, of moderate size; not covered by the skin.

Nostrils mostly lateral; the posterior directly in front of the eyes, the anterior near the margin of the snout and tubular.

Mouth with the cleft slightly oblique, extending below or little behind the eyes.

Jaws well developed; maxillines approximated to the front of the

vomer, with the clamping processes selliform and appressed closely to the sides of the ethmo-vomer behind its head, with ledge-like extensions within, and attenuated backwards.

Mandible moderately stout; the dentary with the coronoid process well developed near its posterior end; the articular little produced externally in front of the condyle, but considerably extended backwards and below.

Teeth conic, in cardiform bands on the jaws and vomer.

Lips thick, mostly with free lateral margins, but undifferentiated in front.

Tongue well developed and free at its anterior portion as well as sides.

Periorbital bones moderately developed.

Opercular apparatus well developed; operculum lamelliform and oblong, inserted high up on the hyomandibular; suboperculum falciform, bordering the operculum; interoperculum large, partly covered by the preoperculum; preoperculum well developed, lamelliform.

Branchial apertures lateral vertical slits in front of and lower than the inferior rays of the pectoral fins.

Branchiostegal rays in moderate number (about twelve), some attached to the ceratohyal and others to the epihyals, quite robust and much bowed.

Dorsal, anal, and caudal confluent in one uninterrupted fin with the rays readily perceptible through the thin skin; dorsal commencing far behind the head and little before the anus; anal close behind the anus; caudal prominent.

Pectorals well developed, nearer the breast than back, with the rays distinct, unbranched, and articulated.

Branchial arches nearly complete, with well developed glossohyal and urohyal, but with the first and second basibranchials only ossified; the first and second hypobranchials ossified, third and fourth cartilaginous; ceratobranchials and epibranchials, of four pairs, ossified; pharyngo-branchials of first and second pairs, rod-like; of third and fourth pairs, in close apposition and developed as dentigerous epipharyngeals; hypopharyngeals oblong and closely apposed and superincumbent on a rudimentary fifth arch, covered with cardiform teeth. Interbranchial slits extended.

There are numerous other characters which support the family distinction of the Anguillidæ, but the only ones that need be here added are the separation of the two frontals, the oblique, forward trend of the suspensorium, and the moderate development of the hyomandibular.

Only one genus of the family is known—that generally called *Anguilla*, but also by Bleeker and some others endowed with the name *Muraena*.

Anguilla is generally ascribed by authors to "Thunberg," but without any definite reference to place of publication. Agassiz, in his "Nomenclator Zoologicus," refers to "*Anguilla*, *Thunb.*, Nuov. Mem. Stock.,

179-," and Günther to "*Anguilla* (Thunberg) Cuv. Règne Anim."; but no such name is to be found in the Memoirs of the Stockholm Academy.

The first division of the old genus *Muraena* appears to have been made by Thunberg or Ahl in 1789 in an inaugural dissertation.* Therein the genus *Muraena* is subdivided into, *Muraena* restricted to species without pectoral fins, and *Ophichthus* proposed for those with such fins. The species enumerated are as follows:

<i>Muraena</i> .	<i>Ophichthus</i> .
1. <i>M. helena</i> L.	1. <i>O. ophis</i> .
2. <i>M. nebulosa</i> .	2. <i>O. serpens</i> .
3. <i>M. picta</i> .	3. <i>O. cinereus</i> .
4. <i>M. annulata</i> .	4. <i>O. myrus</i> .
5. <i>M. fasciata</i> .	5. <i>O. conger</i> .
	6. <i>O. anguilla</i> .

The name *Muraena* was thus definitely restricted to species without pectoral fins, and therefore the subsequent restriction of it to species with pectoral fins, and especially to *M. anguilla*, as Professors Jordan and Gilbert† have already shown, was illegitimate. If not belonging to *Ophichthus*, it was necessary, consequently, that another generic name should be given to the *Anguilla*. *Ophichthus*, indeed, proved to be a very incongruous group, each species representing a peculiar genus. Genera were proposed for them as follows:

<i>O. ophis</i> .	<i>Ophichthys</i> , Ahl., 1789.
<i>O. serpens</i> .	<i>Leptognathus</i> Sw. 1839.‡
<i>O. cinereus</i> .	<i>Muraenesox</i> , McCl., 1843.
<i>O. myrus</i> .	<i>Myrus</i> Kaup., 1856.
<i>O. conger</i> .	<i>Conger</i> , Cuv., 1817.
<i>O. anguilla</i> .	<i>Anguilla</i> Shaw, 1803.

The name *Anguilla* therefore rightly belongs to the division so named, but (unless there is some memoir that has been overlooked) must be credited to Shaw and not Thunberg. The synonymy of the genus will then be, in brief, as follows:

ANGUILLA.

- < *Anguilla* Shaw, Gen. Zool., v. 4, p. 15, 1803.
- < *Anguilla* Cuvier, Règne, Animal, v. 2, p. 230, 1817.
- = *Anguilla* Kaup, Cat. Apodal Fish, p. 32, 1856.
- = *Muraena* Bleeker Atlas, Ich. Ind. Neerland, v. 4, p. 1, 1864.
- Muraena* sp. anct. vet.
- Ophichthus* sp. Thunberg, Ahl.

* Specimen ichthyologicum de *Muraena* et *Ophichtho* quod seria exp. fac. med. Ups. præs. Carol. Vet. Thunberg aequite, etc. modeste offert Jonas Nicol. Ahl. 27. Jan. 1739. Upsalia.

† On the nomenclature of the genus *Ophichthus* < Proc. U. S. Nat. Mus., v. 5, pp. 648-651.

‡ See Jordan & Gilbert, *op. cit.*

THE OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY SYNAPHOBANCHIDÆ.

BY
THEODORE GILL, M.D., PH.D.

The family *Synaphobranchidæ* was indicated in 1862 by Mr. James Yates Johnson in "Descriptions of New Genera and Species of Fishes obtained at Madeira." It was, however, based on superficial characters, and little idea could be derived from the characters visible externally as to the real affinities of the type. Mr. Johnson's diagnosis was as follows:

This genus [*Synaphobranchus*] forms the type of a new family of malacopterygian apodals, which differs from all previously established families, except the *Synbranchidæ*, in having the gill-openings close together on the ventral aspect; and from the *Synbranchidæ* it is distinguished by the presence of fins. Moreover, from the *Muraenidæ* it is separated by the possession of pectoral fins, and from the *Congridæ* by the possession of scales and by the vent being before the commencement of the dorsal fin.*

Nothing has been since added to our knowledge of the essential characters of the group, although a number of additional species have been made known. The following description will therefore prove to be useful, it is thought.

SYNAPHOBANCHIDÆ.

Synonyms as family names.

- = Synaphobranchidæ, Johnson, Proc. Zool. Soc. London 1862, p. 169.
- = Synaphobranchoides, Bleeker, Atlas Ich. Indo-Neerland., v. 4, p. 13, 1864.
- = Synaphobranchidæ, Gill, Arrangement Fam. Fishes, p. 20, 1872; Gill, Standard Nat. Hist., v. 3, p. 103, 1885.
- = Synaphobranchidæ, Jordan & Gilbert, Syn. Fishes N. Am., p. 364, 1882.

Synonym as group name.

- = Synaphobranchina, Günther, Cat. Fishes B. M., v. 8, pp. 19, 22, 1870.

DIAGNOSIS.

Enchelycephalous Apodals with conic pointed head, moderate opercular apparatus, lateral maxillines, cardiform teeth, distinct tongue, inferior branchial apertures discharging by a common aperture, continu-

*Proc. Zool. Soc. London, 1862, p. 169.

ous vertical fins, pectorals well developed, scaly skin, and nearly perfect branchial skeleton.*

Description.

Body slender anguilliform, moderately compressed anteriorly, much compressed toward end of tail, and with the anus in the anterior third of the total length.

Scales small, linear or elongate elliptical, arranged in small groups obliquely at right angles to those of the neighboring groups.

Lateral line distinct, more or less high up and on each side of the back in front, but gradually declining, and near the middle behind.

Head moderate, compressed, oblong, conic laterally, with all the bones invested in the skin.

Eyes within the anterior half of the head, directed sideways, of moderate or large size, covered by thin skin.

Nostrils lateral, the posterior considerably in advance of the lower half of the eye, the anterior near the tip of the snout and subtubular.

Mouth with the cleft slightly oblique, extending considerably beyond the eyes.

Jaws well developed; maxillines approximated close to the front of the vomer, with the clamping processes selliform and appressed closely to the sides of the vomer behind its head, with ledge-like extensions within along the anterior half, and expanding vertically backwards; mandible slender, the dentary with the coronoid process obsolete, the surface of the bone having a corneous appearance behind, ensheathing the articular, which extends well forward in front of the condyle and scarcely at all backwards.

Teeth conic, in a narrow band in the jaws and vomer.

Lips obsolete.

Tongue little developed.

Periorbital bones almost membranous.

Opercular apparatus feebly developed; operculum lamelliform and claviform, inserted very low on the hyomandibular; suboperculum expanding downwards and with an anterior process continued in front of the operculum; interoperculum lamelliform, intervening between the suboperculum and preoperculum; preoperculum almost reduced to a muciferous canal.

Branchial apertures inferior and confluent in a single external longitudinal slit.

Branchiostegal rays in moderate number (about fifteen), attached to the sides of the compressed ceratohyal and epihyal, slender, abbreviated, and moderately bowed, not being curved up above the operculum.

Dorsal, anal, and caudal confluent in an uninterrupted fin, with the

* If we look to the essential characters, however, rather than to those which will enable the group to be recognized in comparison with the other families as readily as possible, the family can be defined as enchelycephalous apodals with abbreviated branchiostegal rays and single ventral branchial aperture.

rays readily perceptible through the skin ; dorsal variable, commencing behind or in front of the anus and mostly low ; anal deeper and commencing close behind the anus ; caudal prominent.

Pectorals well developed, near the breast, with the rays distinct.

Branchial arches nearly complete, with slender glossohyal and urohyal, and with the first, second, and third basibranchials ossified, first and second hypobranchials ossified, third cartilaginous, ceratobranchials and epibranchials of four pairs ossified ; pharyngobranchials of second pair rod-like, of third pair developed as dentigerous epipharyngeals ; hypopharyngeals oblong, closely apposed to and superincumbent on the rudimentary fifth arch. Interbranchial fissures extended.

The osteological characters supporting those enumerated are many and important. It need only be added here, however, that the ectopterygoid is developed as a slender rod bordering the membranous palatal roof, and that the hyomandibular is very large and directly obliquely backwards, and, inasmuch as the facet for articulation of the operculum is near the distal extremity, the opercular apparatus is thereby thrown far away from the cranium. The corneous appearance of the dentary is striking, but of more importance is the extension forward of the articular bone. Perhaps the most obvious character is the abbreviation of the branchiostegal rays entailing a striking contrast to the other eels of the families *Simenchelyidae*, *Congridae*, *Anguillidae*, *Ophisuridae*, and *Muraenidae*, in which they are much elongated and sweep around the opercular apparatus, often intervening between it and the cranium.

There are two external features which are interesting on account of their bearings on the relationship of the family. They are (1) the character of the scales and (2) the position and approximation of the branchial apertures.

The form and mode of distribution of the scales (elongated and elliptical, distant, and arranged in patches at right angles to neighboring ones) are so marked that it might well be thought at first that they must indicate genetic relationship among the fishes so distinguished. If the eels alone were to be considered, it might be argued, with considerable plausibility, that the forms so characterized were descended from common ancestors so distinguished. It would even be difficult to present cogent arguments against such a postulate. But the structural differences between the several types so distinguished (*Anguillidae*, *Synphobranchidae*, and *Simenchelyidae*) are very great, and that the same mode of squamation may originate independently is evidenced by the fact that among the ophidiids a like form and arrangement of the scales is to be found, although among others of the same family the usual form and imbrication of the scales occurs.

The approximation of the branchial apertures beneath the throat and their cincture by a common border recall the symbranchiate fishes, and on account of this character the present family has been compared

with, and might even be approximated to, those fishes. In this case, however, it will be evident, on comparing the structural characteristics of the several forms, that the resemblance is entirely illusive. As will be manifest on perusal of the description of the Synaphobranchroid characteristics, the family is typically apodal, and closely related to the *Congridæ*, *Anguillidæ*, and kindred families. On the other hand, the Synbranchiate fishes have little in common with the true apodal fishes, except the eel-like form. Their structural features are entirely different. They are, in fact, more nearly related to the ordinary physostomous fishes than to the apodal, agreeing with the former, and differing from the latter in the constitution of the circumoral bones (jaws, etc.), the palato-pterygoid arches, and even the cranium, especially in the possession of the exoccipital condyles.

Two genera are known of the *Synaphobranchidæ*, and they are closely related, although differing markedly in the extent of the development of the dorsal fin forwards.

I. SYNAPHOBRANCHUS.

Synonymy.

= Synaphobranchus *Johnson*, Proc. Zool. Soc., London, 1862, p.
 < Synaphobranchus *Günther*.

II. HISTIOBRANCHUS.

Synonymy.

= Histiobranchus *Gill*, Proc. U. S. Nat. Mus., v. 6, p. 255, 1883.
 < Synaphobranchus sp. *Günther*.

THE OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY MURÆ- NIDÆ.

BY

THEODORE GILL, M. D., PH. D.

In a former communication (Proc. U. S. Nat. Mus., 1890, pp. 157) I have given "the osteological characteristics of the family *Anguillidæ*." I now give those of one of the families most remote from that type and the very great differences between the two will be readily apparent from the comparison of the descriptions and illustrations of the two forms. So great indeed are the differences that Professor Cope has taken the two as types of different *orders* of fishes. No one who bases his views on morphology rather than on superficial resemblance in form will deny that they are at least very distinct families.

MURÆNIDÆ.

Synonyms as families.

- <Ophichthyctes, *Duméril*, Zool. Anal., p. 152, 153, 1806.
- <Anguillide, *Raf.*, Indice d' Ittiol. Sic., p. 37, 1810.
- <Peropteria, *Raf.*, Analyse de la Nature, fam., 1815.
- <Anguilloides, *Latreille*, Fam. Nat. du Règne An., p. 142, 1825.
- <Les Murénides, *Risso*, Hist. Nat. Europe mérid., t. 3, p. 189, 1826.
- <Anguilliformes, *Cuvier*, Règne Animal, t. 2, p. 229, 1817; 2^e éd., t. 2, p. 348, 1829.
- <Murænidæ, *Bonaparte*, Giorn. Accad. d. Scienze, v. 52 (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 34), 1833.
- <Murænidæ, *Bonaparte*, Nuovi Annali delle Sci. Nat., t. 2, p. 133, 1838; t. 4, p. 276, 1840.
- <Murénides, *Agassiz*, Recherches sur les Poissons Fossiles, v. 4, p. [xiii, 2, 12,] 41,* 1843.
- <Murænidæ, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 2, pp. 195, 333, 1839.
- <Murænoidei, *Müller*, Abhandl. Akad. Wiss. Berlin, 1846, p. 193.
- <Murænidæ, *Bonaparte*, Cat. Metod. Pesci Europei, p. 6*, 38*, 1846.
- <Murænidæ, *Adams*, Man. Nat. Hist., p. 110, 1854.
- <Murænidæ, *Kaup*, Archiv f. Naturgesch., 22 Jg., B. 1, p. 32, 1856.
- <Murænidæ, *Kaup*, Cat. Apod. Fish. B. M., p. 55, 1856.
- <Murænidæ, *Richardson*, Encycl. Brit., v. 12, p. 23, 1856.
- <Murænoidei, *Bleeker*, Enum. Sp. Piscium Arch. Ind., p. xxiii, 1859.
- =Gymnothoracoidei, *Bleeker*, Atlas Ich. Indo-Neerland., v. 4, p. 72, 1864.
- <Murænidæ, *Günther*, Cat. Fishes in Brit. Mus., v. 8, p. 19, 1870.
- <Murænidæ, *Cope*, Trans. Am. Phil. Soc., n. s., v. 14, p. 456 (Oct. 7, 1870), 1871.
- =Gymnothoracide, *Cope*, Trans. Am. Phil. Soc., n. s., v. 14, p. 456.
- =Murænidæ, *Gill*, Arrangement Fam. Fishes, p. 20, 1872.
- =Murænæ, *Fitzinger*, Sitzungsber. k. Akad. der Wissensch. (Wien), B. 67, 1. Abth., p. 45, 1873.

- =Gymnothoracidi, *Pocoy*, Anal. Soc. Esp. Hist. Nat., t. 4 (Enum. Pisc. Cub., p. 10), 1875.
 <Murænidæ, *Günther*, Int. to Study of Fishes, p. 669, 1880.
 <Murænidæ, *Moreau*, Hist. Nat. Poissons France, t. 3, p. 574, 1881.
 =Murænidæ, *Jordan & Gilbert*, Syn. Fishes N. Am., p. 355, 1882.
 =Murænidæ, *Gill*, Standard Nat. Hist., v. 3, p. 107, 1885.

DIAGNOSIS.

Colocephalous Apodals with conic head, feebly developed opercular apparatus, long and wide ethmoid, posterior maxillines, pauciserial teeth, roundish lateral branchial apertures, diversiform vertical fins, pectoral fins (typically) suppressed, scaleless skin, restricted interbranchial slits, and very imperfect branchial skeleton, with the fourth branchial arch modified, strengthened, and supporting pharyngeal jaws.*

Description.

Body typically anguilliform, subcylindrical forwards, compressed backwards, with the caudal portion gradually attenuated backwards, and with the anus near or in advance of the middle of the length.

Scales absent.

Lateral line generally absent.

Head moderate or small, conic, with all the bones invested in the muscles or skin.

Eyes typically well advanced within the anterior half of the head, directed sideways, of moderate or small size and not covered by the skin.

Nostrils diversiform; posterior in front of or partly above the eyes, anterior near the margin of the snout and generally tubular.

Mouth with the cleft more or less extending beyond the eyes.

Jaws well developed; maxillines far from snout, with the anterior end enlarged and articulating with the oblique truncated lateral extensions of the vomer, and with the clamping processes little developed and not directly appressed to the sides of the vomer, with slight ledge-like extensions behind, but attenuated backwards; mandible moderately stout, but with the dentary elongated, with the coronoid process well developed some distance from its posterior end, the articular little produced externally beyond the condyle (but reaching well forwards internally) and not, or little, extending beyond the condyle backwards.

Teeth diversiform, generally acute and some enlarged, sometimes blunt, generally extending on the shaft of the vomer as on the jaws.

Lips obsolete.

Tongue suppressed.

Periorbital bones moderately developed.

Opercular apparatus reduced; operculum pedunculated and decurved, inserted low down in the hyomandibular; suboperculum interposed be-

* If a still shorter diagnosis be desired, the family be contrasted with all others, so far as known, as *tongueless engyschistous Apodals*, or, again, as *Apodals with the fourth branchial arch limited to the ceratobranchials and epibranchials strengthened and closely applied to elongated pharyngeal bones*.

hind the hinder edge of the operculum; interoperculum small, between the suboperculum and preoperculum; preoperculum small and with muciferous pores.

Branchial apertures lateral and roundish or irregular, generally little nearer the breast than back.

Branchiostegal rays in moderate number ($9-\chi$), concentrated backwards and confined to the epihyals, very slender and much bowed.

Dorsal, anal, and caudal, when developed, confluent in one uninterrupted fin, with all the rays invested in the common integument, and imperceptible without dissection; dorsal diversiform, generally commencing near the head, but sometimes atrophied; anal generally commencing near the anus, but sometimes atrophied; caudal always feebly developed; pectorals generally absent, rarely developed.*

Branchial arches incomplete, without a glossohyal or urohyal, but with the ceratohyals connected directly with the symphysis of the mandible by a ligament; with all the basibranchials and hypobranchials obsolete, the ceratobranchials being united with common cartilage below; ceratobranchials and epibranchials of the first, second, and third arches very slender, of the fourth arch very robust, the ceratobranchials of the fourth arch dislocated upwards and apposed to the hypopharyngeals, as are the epibranchials to the epipharyngeals; pharyngobranchials lost, except one pair which are developed as elongated denticulous epipharyngeals; hypopharyngeals elongated, superposed on the fourth pair of ceratobranchials as are the epipharyngeals on the same pair of epibranchials, the arch thus constituted forming a pair of pharyngeal jaws, behind which is a slender fifth arch; the pharyngeal teeth acute and in one or few rows. Interbranchial slits narrow.

Numerous other osteological peculiarities distinguish this type, but those now given will sufficiently differentiate it from any others.

Inasmuch as there are certain discrepancies between the description here given and the characteristics assigned to the same type by Professor Cope, an explanation seems to be demanded.

Professor Cope has defined the group constituted by the *Muraenida* as an order in the following terms:

COLOCEPHALI.

Parietals largely in contact; opercular bones rudimental; the præoperculum generally wanting.† Premaxillary rudimental or wanting; ethmoid very wide. Symplectic, maxillary, pterygoid, basal-branchiyl, superior and inferior pharyngeal bones all wanting, except the fourth superior pharyngeal. This is jaw-like and supported by a strong superior branchiyl; other superior branchiyls wanting or cartilaginous.‡

* *Myroconger* with pectoral fins is placed by Dr. Günther (Cat. Fishes B. M., v. 8, p. 93) in the section of *Muraenida engyschista*, characterized by the fact that "the branchial openings in the pharynx are narrow slits," and otherwise composed of typical *Muraenida*.

† Pterygoids rudimental or wanting.—Proc. A. A. A. S.

‡ Trans. Phil. Soc., n. s., v. 14, p. 456, 1871. See also Proc. Phil. Soc., v. 13, 1873, p. 25.

In the relations of the parietal and opercular as well as pterygoid bones the Murænids differ from the Anguillids only in degree, and the preoperculum and pterygoid are manifest in the former, although less developed than in the latter. Both want the symplectic. The maxillaries are developed, as Professor Cope later recognized.* The "inferior pharyngeal bones" are also well developed in the Murænids, and, although shifted from the fifth arch to the back of the fourth,† they are evidently homologous with the inferior pharyngeal bones of the true eels and other fishes. "Other superior branchi-hyals" (than the fourth) are not "wanting or cartilaginous" for those of the first three arches are developed in due proportion.

Professor Cope recently has again defined the *Colocephali*,‡ contrasting the group with the *Enchelycephali* (or true eels) and *Lyomeri* by their having "opercular bones, and one osseous branchial arch, ceratohyal," the *Enchelycephali* having "five osseous branchial arches, with ceratohyal."

But the five branchial arches of the Murænids in part at least are also ossified, as well as the ceratohyal (*i. e.* ceratobranchial), and the elements are developed as explained in the full description of the family herewith given.

Professor Cope in his first arrangement (Trans. Am. Phil. Soc., n. s., v. 14, p. 456) recognized only one family of Colocephali, the *Murænida*, but under the *Enchelycephali* he had a section (3.) distinguished by having "no pectoral fins; no metapterygoid; pterygoid a slender rod; ethmoid much wider," and the section so distinguished was called the family "*Gymnothoracida*." It was later (Proc. Am. Phil. Soc., v. 21, p. 25) stated that the family *Gymnothoracida* was a synonym of *Murænida*. "Its presence out of place is probably the result of a clerical mistake in not eliminating it from a previous MS., written before the distinction between the orders *Enchelycephali* and *Colocephali* was recognized. As it was inserted under the latter head, its omission from the former was to be understood."

Professor Cope in his later "observations" (Proc. A. A. A. S., 1871, 335, p. 1872) admitted two families in his order *Colocephali*, distinguished as follows:

"A glossohyal and osseous lateral branchi-hyals; four opercular bones; a scapular arch	<i>Rataburida</i> .
No glossohyal nor osseous branchi-hyals; three or fewer opercular bones; no scapular arch	<i>Murænida</i> .

The *Rataburida* (or *Moringuida*) appear to be amply distinguishable

* Proc. Am. Phil. Soc., v. 21, p. 583, 1884.

† Professor Cope later (Proc. Am. Phil. Soc., v. 21, p. 584, 1884) explained that "in the Colocephali all these elements (*i. e.* glossohyal, "basihyals, and axial branchi-hyals," etc.) are wanting excepting the fourth superior pharyngeal, which has the form of an antero-posteriorly placed dentigerous jaw, which *opposes the lateral branchi-hyal of the fifth arch*, or, as it is generally called, the *inferior pharyngeal*."

‡ Am. Nat., v. 23, p. 858, 1890.

from the *Muraenidae*, but not by the characters thus given. As already shown, the *Muraenidae* have osseous branchiyls and perfect skeletons, probably, never have fewer than four opercular bones; finally, if *Myroconger* belongs to the family, "a scapular arch" is at least sometimes present. It is in fact represented by cartilage in the typical *Muraenidae*.

Professors Jordan and Gilbert, in their "Synopsis of the Fishes of North America" (1882), have recognized the family *Muraenidae* with the same limits assigned to it by Cope. In their "Analysis of Families of Apodes" (p. 35), they have contrasted the *Muraenidae* in a section (a) characterized by "*preopercle wanting; lower pharyngeals wanting; gill-openings very small,*" with another section (b) distinguished by "*preopercle present; lower pharyngeals present.*" Inasmuch as no such differences exist, the student would be at first thrown off the track in his attempt to identify a muraenoid fish. The characters assigned must not be considered, however, to be the results of independent observations by the authors, for there is good reason to believe that they solely relied upon Professor Cope for the osteological characters mentioned in their description of the family.*

The limits of the family *Muraenidae* are well determined except in the case of the genus *Myroconger*. That genus has been referred to the *Muranina* by Dr. Günther simply because it is engyschistous. When the extent to which fishes of other families vary in the extent of at least the last branchial slit is remembered, the value of such a character may well be exaggerated. Nevertheless the genus *Myroconger* may be provisionally retained among the Muraenids until its osteology or branchial apparatus is known. Inasmuch, however, as the total suppression of the pectorals is characteristic of the typical *Muraenidae*, and as *Myroconger* has well-developed pectorals "about as long as the snout," which itself is "of moderate length," it may be well to isolate that genus as the representative of a peculiar subfamily (*Myrocongrinae*) and to keep it in abeyance as a doubtful constituent of the family *Muraenidae*.

Not less than twenty-six generic names have been proposed for the family. Many, if not most, of these are undoubtedly superfluous, but there is danger of going to an opposite extreme in reducing the number to three or four (including *Myroconger*), as has been done by Dr. Günther. The course followed by Bleeker and Jordan seems to be the most judicious, and thirteen genera appear to have characters entitling them to such rank. A considerable range of variation is manifested by these genera judging from the external appearance, may be found to be coordinated with good osteological characteristics.

* Professors Jordan and Gilbert, in another place (Syn. Fishes, N. A., p. 82), have frankly acknowledged that "the osteological characters here [there] and elsewhere in this work are mostly taken from Cope's Contribution to the Ichthyology of the Lesser Antilles. Trans. Am. Phil. Soc., 1870."

GENERA OF MURÆNIDÆ.

MYROCONGRINÆ.

(Doubtfully murænoid.)

1. MYROCONGER *Günther* Cat. Fishes B. M., v. 8, p. 93, 1870.
Type *M. compressus* *Günther*.

MURÆNINÆ.

1. MURÆNA *Linn.*
Type *M. helena* *Linn.*
2. SIDERA *Kaup*, Cat. Ap. Fish. B. M., p. 70, 1856; *Jordan & Gilbert*, Proc. U. S. Nat. Mus., v. 6, p. 209, 1883.
Type *S. picta* (*Ahl*).
3. PYTHONICHTHYS *Poey*, Repertorio Fis. Nat. de Cuba, v. 2, p. 264, 1868.
Type *P. sanguineus* (*Poey*).
4. PRIODONTOPHIS *Kaup*, N. alähnl. Fische Hamburger Mus., 1859; *Bleeker*, Atlas Ich. Ind. Néerland., v. 4, p. 74, 1864.
Type *P. ocellatus* *Ag*.
5. EURYMYCTERA *Kaup*, Cat. Ap. Fish. B. M., p. 72, 1856.
Type *E. schismatorhynchus* (*Bleeker*).
6. ENCHELYCORE *Kaup*, Cat. Apod. Fish B. M., p. 73, 1856.
Type *E. nigricans* (*Bonnaterre*).
7. STROPHIODON *McClelland*, Calcutta Journ. Nat. Hist., v. 5, p. 215? 1844; *Bleeker*, Atlas Ich. Ind. Néerland., v. 4, p. 108, 1864.
Type *S. sathete* *Ham. Buch*.
8. THYRSOIDEA *Kaup*, Cat. Apod. Fish B. M., p. 73, 1856; *Bleeker*, Atlas Ich. Ind. Néerland., v. 4, p. 110, 1864.
Type *T. macrurus* *Bleeker*.
9. RHINOMURÆNA *Garman*, Bull. Essex Inst., v. 20, p. 114, 1888.
Type *R. quasita* *Garman*.
10. ECHIDNA *Forster*, "Echirid. h. n. 81," Walbaum, Artedi Gen. Pisc., p. 695, 1792; *Bleeker*, Atlas Ich. Ind. Néerland., p. 77, 1864 = *Pacilophis Kaup*, Cat. Apod. Fish B. M., p. 98, 1856.
Type *E. nebulosa* (*Ahl*).
11. MURÆNOBLENNA *Lacépède*, Hist. Nat. Poissons, v. 5, p. 652, 1803; *Jordan*, Proc. U. S. Nat. Mus., v. 5, pp. 575, 576, 1883 = GYMNUMURÆNA* *Bleeker, Günther et al* (not *Kaup*).
Type *M. olivacea* *Lacépède*.
12. CHANNOMURÆNA, *Richardson*, Ich. Erebus & Terror, p. 96, 1847.
Type *C. vittata* *Richardson*.

* The name *Gymnomuræna* has been used for another genus, viz :

GYMNUMURÆNA *Lacépède*, Hist. Nat. Poissons, v. 5, p. 648, 1803; *Kaup*, Cat. Apod. Fish B. M., p. 103, 1856; *Jordan & Gilbert*, Proc. U. S. Nat. Mus., v. 5, p. 574, 1883.

Type *G. zebra* (*Shaw*).

The differences between this "genus" and *Echidna* appear to be due chiefly to age, as *Bleeker* has shown.

ON THE DISAPPEARANCE OF THE DICK CISSEL (*SPIZA AMERICANA*) FROM THE DISTRICT OF COLUMBIA.

BY

HUGH M. SMITH,
Assistant, U. S. Fish Commission.

While it is a matter of no great rarity for certain of the larger birds inhabiting a particular region to become scarce, or locally extinct, because of the direct persecution and slaughter carried on by man or on account of the cutting away of forests and other similar procedures, instances of the disappearance of small birds from a locality which they have regularly frequented are by no means common, especially when this disappearance is independent of the agency of man.

Such is the case of the Dick Cissel in the vicinity of Washington. At one time an abundant summer visitant, it is now a veritable *rara avis*.

Speaking of this subject in their "Avifauna Columbiana," Coues and Prentiss say:

This bird used to arrive regularly about the first of May, and leave toward the end of September, meanwhile being very abundant. * * * Now, however, the bird appears to have forsaken us, few if any having been heard of for the past few years. * * * Whatever the cause, it is one of the most remarkable changes in the bird fauna of the immediate vicinity of the city.

This was in 1883. At the present time there can be no doubt that the species is nothing more than the most accidental straggler, since only one bird has been observed during the past fifteen years, notwithstanding the activity of the local collectors in searching for the species.

The late Professor Baird stated a short time before his death that he remembered when the Dick Cissel nested commonly in the Smithsonian Grounds, and he was accustomed to observe the birds daily at the proper season as he passed to and from his work in the Institution.

Through the courtesy of Mr. Ridgway, the Curator of the Department of Birds, it has been possible to prepare the following list, showing all

the specimens from the District that found their way to the Smithsonian Institution:

Museum number.	Date.	Sex.	Collector.
10133		♀	J. C. McGuire.
12235	May 25, 1859	♀	C. Drexler.
59415	May 17, 1860	♂	D. W. Prentiss.
83771	May 10, 1861	♂	Elliott Coues.
10132		♂	J. C. McGuire.
28630			C. Drexler.
29095	June, 1856.		Elliott Coues.
29096	May 13, 1859		Do
30043			D. W. Prentiss.
30044	Jan. 25, 1860	♂	Do
30045	May 10, 1861	♂	Do
59416	May, 1860	♂	Do
59417		♀	Do

Of these thirteen specimens, only the first four are now in the museum collection, all the others having probably been exchanged many years ago. The only other specimen extant, so far as known, is a female in the possession of the writer, taken by Dr. T. C. Smith in 1861.

It will thus be seen that no specimens of this species have been obtained for nearly thirty years. During the first half of that period the bird was still a regular sojourner with us, Mr. Ridgway having found it not uncommon on Columbia Heights about 1872 or 1873, and in 1874 he observed a male on the Virginia side of the Potomac River above the Aqueduct Bridge. He has seen none since that time and believes, as the result of his observations, that the species does not now breed within 40 miles of Washington.

The most recent and, in fact, the only other record of the bird's occurrence was in May, 1887, when Mr. H. W. Henshaw saw a male in a field beyond Soldiers' Home, a locality which the species formerly frequented.

Mr. Ridgway's intimate knowledge of the habits of the dick cissel in the Mississippi Valley leads him to state that its occurrence in abundance in 1860 is almost as much of a mystery as its absence in 1890, inasmuch as it is a bird of the prairies and extensive natural meadows, such as clover fields—topographical conditions not existing in the vicinity of Washington.

DESCRIPTION OF A NEW SPECIES OF BAT, *ATALAPHA SEMOTA*.

BY

HARRISON ALLEN, M. D.

I have lately received from the National Museum a number of examples of a bat which bears the manuscript label: "*Atalapha semota*, Sandwich Islands."

Mr. Frederick W. True informs me that these specimens were so named by himself, but that no description of them has as yet appeared. A careful examination of the material (which consists of one perfect adult specimen, one mutilated specimen in alcohol, seven skins and crania) leads me to confirm the opinion of Mr. True. I propose herewith to describe the species as follows:

Atalapha semota True.

Auricle.—Internal basal lobe extends back as far as a point near the posterior margin of the tragus. Internal ridge rudimental. External basal lobe semicircular, thin membranous, not revolute. External ridge conspicuous and extends nearly to the tip of the auricle, parallel with the broad membranous hem. The entire auricle lies close to the head, *i. e.*, the fold between the head and the auricle is small.

Coloration.—Fur, much as in other species of the genus. Dorsum, crown, nape, back of neck, and chest with long, soft fur with brown-ash tips; shafts at apical half, white; basal half, black. A band of warm-sepia lies across the neck and shoulders. Loin with long rusty-brown tips to the shafts, whose apical half is obscurely pallid and basal half black. Over the interfemoral membrane and the wing membrane near it, the fur is of a deep russet-brown or rusty red. The membrane, for the most part, is uniformly clothed. The marginal third in three examples is sparsely furnished with hair. The cheeks and lips are covered with black hair. The ears are likewise hairy on the posterior surface as far as the black border.

The skin over the masseter muscle and thence under the mandible is of a dull whitish color. The hairs of the neck and chest have gray tips and warm-sepia sub-tips; shafts with apical half a dull white; basal half, black. The side of the trunk is covered with longer hair, of which the tips are for the most part a dirty whitish-buff, and is thus

characteristic in appearance. This color extends from a short distance upon the neck on a line with the prebrachium. The pubis is furnished with shorter and more thinly distributed hair, which is obscurely bicolored, the shafts being dusky brown, the tips ashy. The hair on the wing membrane is as in *A. cinerea*.

Skeleton.—The facial portion of frontal bone is greatly inflated, so as to form a swelling in the orbit. The small lachrymal process, which is present in *A. cinerea*, is absent here. In other respects the parts are as in *A. cinerea* and *A. noveboracensis*. Teeth the same as in these species.

The fifth metacarpal bone lacks one-seventh of being as long as the fore-arm; the fourth metacarpal bone is as long as the fore-arm. The fourth metacarpal bone is not concealed when the third and the fifth metacarpals are approximated.

The wing membrane is attached to the epitrochlea, thus leaving the olecranon and the epicondyle free dorsad. Width of prebrachium at the elbow $1\frac{1}{2}$ less than width of membrane from the elbow downward.

Dimensions.—The manal formula is as follows: Fourth interspace, 34^{mm} ; third interspace, 13^{mm} ; difference between third and fourth interspaces, 21^{mm} ; fore-arm, 40^{mm} .

This may be compared with advantage to the manal formula in *A. noveboracensis*: Fourth interspace, 33^{mm} ; third interspace, 10^{mm} ; difference between third and fourth interspaces, 23^{mm} ; forearm, 37^{mm} .

The manal formula of *A. cinerea* is as follows: Fourth interspace, 40^{mm} ; third interspace, $13\frac{1}{2}^{\text{mm}}$; difference between third and fourth interspaces, $27\frac{1}{2}^{\text{mm}}$; fore-arm, 49^{mm} .

Measurements.

	Millimeters.		Millimeters.
Head.....	19	Third digit:	
Trunk.....	32	Metacarpal.....	52
Auricle.....	8	First phalanx.....	18
Tragus.....	7	Second phalanx.....	20
Tibia.....	20	Fourth digit:	
Femur.....	18	Metacarpal.....	47
Calcaneum.....	18	First phalanx.....	$11\frac{1}{2}$
Tail.....	46	Second phalanx.....	14
Fore-arm.....	40	Fifth digit:	
First digit:		Metacarpal.....	40
Metacarpal.....	4	First phalanx.....	9
First phalanx.....	5	Second phalanx.....	8
Second phalanx.....	2		
Second digit:			
Metacarpal.....	51		
First phalanx.....	6		

HAB.—Sandwich Islands. Mr. Valdemar Knudsen.*

* Having been requested to revise the proofs of this article, owing to the absence of the author, I venture to add a few notes regarding the specimens upon which the species is based. With one exception, all were obtained by Mr. Valdemar Knudsen, a former resident of the Sandwich Islands, and for many years a valued correspond-

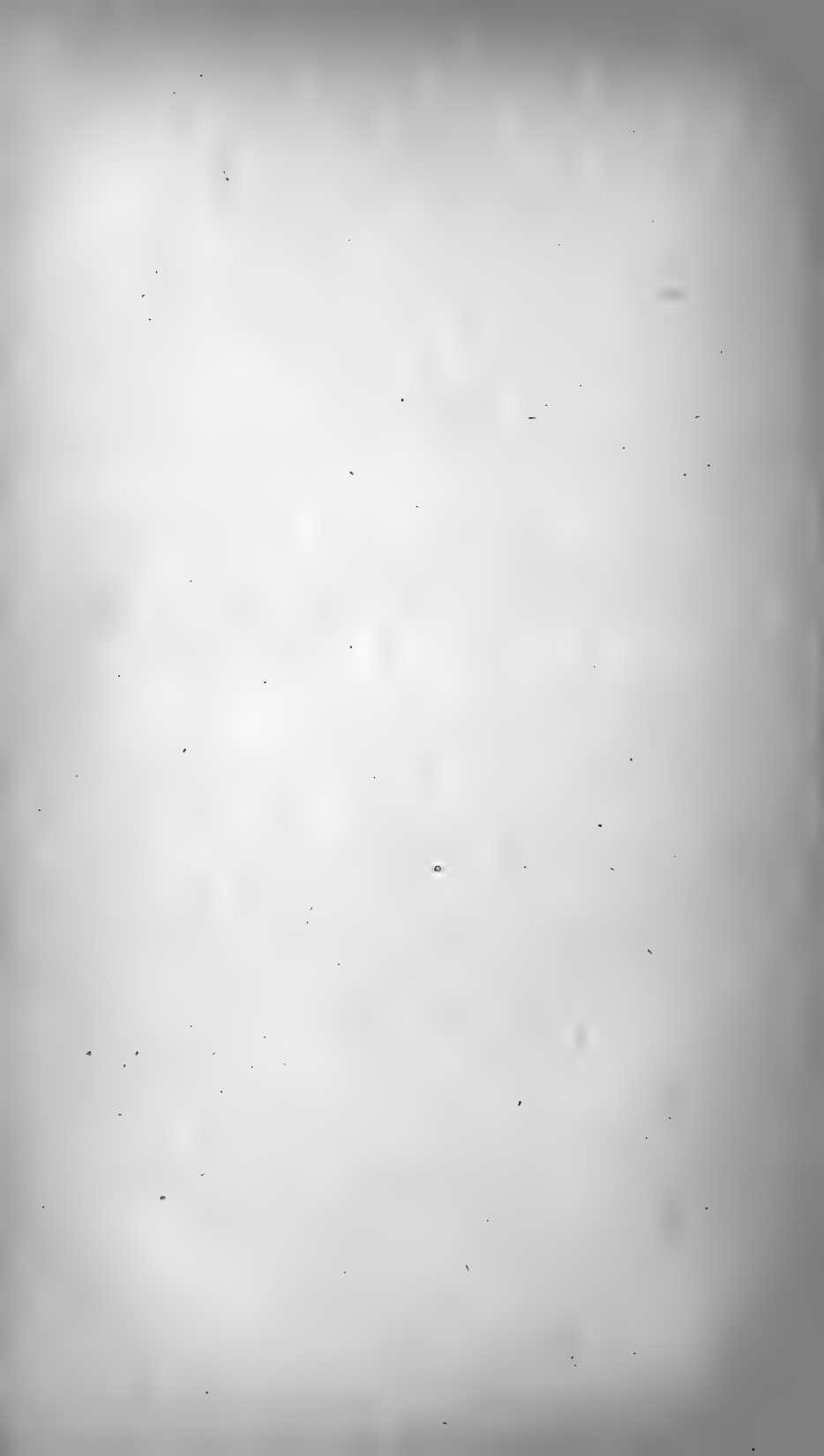
Dr. J. E. Gray (Proc. Zool. Soc. Lond., 1862, 143) asserts that *Atalapha* (*Lasiurus*) *grayi*, Tomes, is found in the Sandwich Islands. Mr. A. Murray (Geographical Distribution of the Mammalia, 1866), apparently on this authority, places the species in the islands named. Dr. G. E. Dobson (Cat. of Chirop. in Brit. Mus.) concludes that *A. grayi* is a variety of *A. cinerea*, and does not refer any examples to localities beyond America. Mr. Tomes in his original description (Proc. Zool. Soc. Lond., 1857, 40) states that two of the type-specimens of *A. grayi* came from Chili, while three were without locality. It remains uncertain, therefore, whether *A. semota* is the same as *A. grayi* as identified by Gray.

ent of the Smithsonian Institution. One specimen was collected by Mr. Charles N. Spencer, at the request of Mr. F. P. Hastings, vice-consul-general at Honolulu. Both collectors agree that the species is very rare and difficult to obtain. Mr. Spencer remarks that its native name is *Olepe*, and that it is the only species in the islands. The specimens which have labels giving the localities definitely are from the island of Kauai, and it remains therefore to be ascertained whether the species occurs on the other Hawaiian islands.

The specimens mentioned by Dr. Allen are the following:

No.	Locality.	Collector.	Nature of specimen.
15631	Sandwich Islands	V. Knudsen	Alcoholic.
15630	Kauai, Sandwich Islands	C. N. Spencer	Skin; body in alcohol.
16138 }	Sandwich Islands	V. Knudsen	Skin and skull.
22930 }			
16139 }	.....do .....	.....do	Do.
22931 }			
15644	.....do .....	.....do	Skin.
15645	.....do .....	.....do	Do.
8545 }	Waimea, Kauai, Sandwich Islands....	.....do	Skin and skull.
22310 }			
8296	[No record] .....	.....do	Skin.

F. W. TRUE.



ON THE SNAKES OF THE GENUS CHARINA.

BY

LEONHARD STEJNEGER,

Curator of the Department of Reptiles and Batrachians.

Within the faunal area of North America, as it is usually understood, only two genera of boid snakes are known to occur, viz, *Charina* and *Lichanura*, which have been referred by Professor Cope to two distinct families, the former to the *Charinidae*, the latter to the *Boidae* proper. The osteological characters which separate these families are as follows:

Charinidae: Coronoid bone and postorbitals absent.

Boidae: Coronoid bone and postorbitals present.

Externally the two genera representing these families in our fauna may be distinguished as follows:

a¹. Frontal plate present, large.....*Charina*.

a². Frontal plate absent*Lichanura*.

The genus *Charina* was instituted by J. E. Gray, in 1849, for a California specimen in the British Museum, which he regarded as *Tortrix bottæ* of Blainville. Three years later Baird and Girard, in describing the reptiles brought home by the famous "United States Exploring Expedition" from our western coast, established the genus *Wenona* for two specimens which they regarded as types of two different species, viz, *W. plumbea* and *W. isabella*. These were afterwards described in greater detail and figured by Girard in the herpetological part of the exploring expedition (pl. vii). Finally, Jan, in 1862, after examining the type and only known specimen of Blainville's *T. bottæ*, expressed the opinion that the specimen so called and described by Gray represented another species and genus, for which reason he named the genus represented by Blainville's species *Pseudoeryx*. In spite of this statement by so high an authority, subsequent writers, who consider *T. bottæ* and *W. plumbea* generically distinct, have continued to call the former *Charina bottæ*. Noteworthy among these is Bocourt, who very forcibly points out the characters of the alleged two genera, though it is plain that Gray's *Charina bottæ*, if tested by Bocourt's own characters, is referable to *W. plumbea* rather than to the true *T. bottæ*.

As to the value of the species described, opinions have varied greatly. Cooper and Suckley (in the P. R. R. Rep., XII, iii, p. 303 (1860), expressed doubt as to the distinctness of *W. plumbea* and *isabella*, the latter stating expressly that "specimens appear to unite the characters of both species." The following year Cope (Proc. Phila. Acad., 1861, p. 305) also expressed as his opinion that both species are probably identical, and since then their identity seems to have been accepted

without further questioning. On the same occasion Cope even went so far as to doubt the specific distinctness of *W. plumbea* and *T. bottæ*, or as they were then for the first time called, *Charina plumbea* and *Ch. bottæ*. Later on he seems to have reversed his opinion and recognized their distinctness, as in his Check-list of North American Batrachia and Reptilia (1875), page 43, he enumerates both, assigning to *Ch. bottæ* as habitat the "Lower Californian region," while *Ch. plumbea* is stated to inhabit the "Pacific region." Whether the omission of *Ch. plumbea*, which he himself has stated to occur in Guaymas, Sonora, (Proc. Phil. Acad., 1861, p. 305), in his Catalogue of Batrachia and Reptilia of Central America and Mexico (1887), page 64, is due to his considering the two species identical is not clear, since *Ch. plumbea* is not mentioned in the synonymy of *Ch. bottæ*. However, in describing *Ch. brachyops* (Pr. U. S. Nat. Mus., XI, 1888, p. 88), he considers them specifically identical with but little doubt. Garman has been equally uncertain as to the status of these forms. At first (Rept. Batr. N. Am., I, Ophid., p. 7) he included both under the name of *Charina bottæ*, the diagnosis of which is evidently made up from descriptions of both, but in the appendix (p. 131) he admits a *Ch. bottæ* var. *plumbea*, the typical form with locality "California to Mexico," the variety ranging through "California to Puget Sound." Still later (List N. Am. Rept. and Batr., 1884, pp. 21, 22), he enumerates them as distinct species. As such they are also treated in Yarrow's Check List of North American Reptilia and Batrachia (1882), page 19. Only one specimen of *Ch. bottæ* seems to have been collected up to the present day, viz, the type which is preserved in the Paris Museum. Besides the original description and figures by Blainville, it has been described both by Jan and by Bocourt and figured by the former. The latter sums up the essential differences which distinguish *Wenona plumbea* from *Charina bottæ*, as he calls them, in the following manner:

(1) Nasals more developed and meeting on the top of the muzzle, thus taking the place of the internasals; (2) five prefrontals instead of only four; (3) eye separated from the supralabials by two suboculars; (4) scales of body somewhat smaller, forming forty-five longitudinal rows instead of thirty-nine only.

These characters are evidently drawn up from two specimens only, the type of *Ch. bottæ* and the specimen of *Ch. plumbea* which the Paris Museum received from the Smithsonian Institution, without regard to the variations of the latter shown in the descriptions and figures previously published. Having nineteen specimens in fair condition before me, I am able to throw some light on the individual variation of these snakes and to make some remarks which may not be without interest. Before discussing the differences between *Ch. bottæ* and *plumbea* it may be well to investigate those of *Ch. plumbea* and *isabella*. As exhibited by the type specimens the characters separating *isabella* from *plumbea* were thought to be as follows: (1), two large prefrontals with an additional small scale wedged in between them posteriorly, instead of four well developed ones; (2) no suborbitals, fourth and fifth labial being

in contact with the eye against two suborbital, and no labials in contact with eye.

From the table which I present below it will be seen that in the whole series no two specimens are alike as far as the plates of the head are concerned. There is hardly an individual with both halves of the head alike, the differences between them in some cases being so great that one side of the head would belong to one genus, the other to another, were we to accept the generic distinctions between *Charina* and *Wenona*, as set forth by Bocourt. Out of twenty specimens, six have four prefrontal plates like the types of *plumbea* (and *bottæ*), while eleven (including Bocourt's specimens) have five such plates, one has seven, one (*isabella* type) three, and one two. These facts seem to dispose of the first distinction between *plumbea* and *isabella*, as well as of the second between *plumbea* and *bottæ*. As to the upper labials being in contact with the eye, or this organ being surrounded by a ring of small scales, I may state that in the type of *plumbea* and eight more specimens the latter condition prevails, while in *isabella* and ten other specimens some of the labials come in contact with the eye. How valueless this character is, however, may be understood from the fact that in one specimen three labials on both sides are in contact; in another two on one side and three on the other; in five including the type, two labials touch the eye on both sides, and in two only one labial on each side, while, more conclusive still, one specimen, so far as labials are concerned, is typical *Ch. plumbea* on one side and equally typical *Ch. isabella* on the other; No. 4497 *b* is about similarly situated, though in this only one labial is in contact on one side, and none on the other. This breaks down very effectually the second barrier between *isabella* and *plumbea* as well as the third between *plumbea* and *bottæ*.

From the above I think it is safe to conclude that *Ch. isabella* is only an individual variation of *Ch. plumbea*.

Two of the distinctions between the latter and *Ch. bottæ*, as tabulated by Bocourt, have already been shown to be due to individual variation. A glance at our table will demonstrate that the first character assigned to *bottæ* as peculiar, viz, the presence of internasals, is shared by No. 12581, which is otherwise a tolerably average *plumbea*, and the numerous indications of the anterior nasal breaking up into a prenasal proper and an internasal, as shown, for instance, on the right side of the type of *plumbea*, proves conclusively to my mind that this character is entirely unreliable.

There remains now the number of scale rows of the body, which in the type of *bottæ* are said to be 39. In this particular we have no connecting link as yet between the two species. The commonest number of scale rows in *plumbea* are 45, though several specimens have 43, and a few 47 to 49. Whether this gap will be filled up remains to be seen, but until this happens *Ch. bottæ* seems entitled to recognition upon this character alone.

The specimen with 49 scale rows (No. 4497*b*) is in many respects a remarkable one, and I have been very much tempted to describe it as a distinct species, for not only is the number of its scale rows excessively large, but the relation between rostral and anterior nostrals is entirely unique, inasmuch as the former entirely separates the two latter, being in contact with the prefrontals, thus destroying what has been considered even a good generic character of *Charina*. This specimen also has the lowest number of urosteges, but taking into account the enormous variability which has been demonstrated above, I think there can be no doubt but that this specimen only represents an extreme individual variation.

Since the above was set in type, five more specimens have come to hand. They are collected by Prof. O. B. Johnson, at Seattle, Wash., and are in many respects very interesting. In the first place, three of them are very large, showing that all the rest of the specimens examined are young ones; in the second place, they bear out the conclusions based on the previous material as given above, and demonstrating still further the enormous individual variation of the cephalic plates, in one specimen the frontal even being divided longitudinally. On the other hand, they establish more firmly 43 scale rows as the minimum of *Ch. plumbea*. They have been included in the table given below.

Quite recently Professor Cope, in these Proceedings (Vol. XI, 1888, p. 88, pl. xxxvi, fig. 2), has described *Ch. brachyops* as a new species with the following diagnosis: "Prenasal separated from internasal; postnasal joining preocular, no loreal; prefrontal entering orbit; one superciliary; superior labials 8 to 9."

As to the labials, 9 seems to be the usual number; sometimes as many as 11 are found, and exceptionally only 8, so that the character derived from them is not diagnostic. Neither is the first character assigned to the new species peculiar to it, for we have seen that it is one of the features ascribed to the type of *Ch. bottæ*, and it is also found in our No. 12581. One superciliary is the commonest number in *Ch. plumbea*, and is also found in *Ch. bottæ*. Even the absence of a loreal is not very unusual in *Ch. plumbea*, in the type specimen of which it is wanting on both sides, while in the type of *Ch. isabella* it is only absent on one side, but in those cases which have come under my observation the loreal has disappeared by being fused with one of the prefrontals, which are thus interposed between the posterior nasal and the anteorbital, while in the type of *Ch. brachyops* the loreal seems to be absorbed by the anteorbital, thus bringing the latter into direct contact with the posterior nasal. The last diagnostic mark of the new species is "prefrontal entering orbit." There is no approach to this character in any other of the *Charinae* before me, though it is doubtful if it is of more value than the "labials entering the orbit" in differentiating *Ch. bottæ* or *isabella*. In addition to these characters the muzzle seems rather depressed as well as narrow, and the eye seems to be somewhat larger than in *Ch. plumbea*, but too great stress can not be laid on these charac-

ters, as the type specimen has dried somewhat out of shape from having been placed in too strong alcohol. The figures accompanying the original description are extremely poor, that representing the top of the head (fig. 2 a) being particularly inaccurate, inasmuch as the rostral and superciliary are drawn nearly twice their comparative size.

On the whole, the status of the new species is about the same as that of *Ch. bottæ*. They should be recognized until conclusively proven to be only individual variations of the same species.

With this proviso, therefore, we distinguish at present three species, as follows:

a¹ 39 scale rows..... *Charina bottæ*.

a² 43 scale rows, or more.

b¹ Posterior nasal not in contact with anteorbital; prefrontal not entering orbit..... *Charina plumbea*.

b² Posterior nasal in contact with anteorbital; prefrontal entering orbit.
Charina brachyops.

The synonymy of the genus and the supposed three species would stand thus:

Charina GRAY.

1849.—*Charina* J. E. GRAY, Cat. Snakes Brit. Mus., p. 113 (type *Ch. bottæ* GRAY = *Ch. plumbea*?).

1852.—*Wenona* BAIRD and GIRARD, Proc. Philada. Acad., 1852, p. 176 (type *W. plumbea*).

1862.—*Pseudoeryx* JAN, Arch. f. Naturg., XXVIII, i, p. 242 (type *Tortrix bottæ* BLAINV.).

1862.—*Wenonia* JAN, Arch. f. Naturg., XXVIII, i, p. 242 (emend.).

Charina bottæ (BLAINV.).

1835.—*Tortrix bottæ* BLAINVILLE, Nouv. Ann. Mus. d'Hist. Nat., IV, p. 289, pl. 26, figs. 1, 1a, 1b.—*Pseudoeryx bottæ* JAN, Arch. f. Naturg., XXVIII, i, 1862, p. 246.—JAN & SORDELLI, Iconogr. Oph., Texte, 2 livr., 1865, p. 67 (3 livr., pl. ii, fig. 1).—*Charina bottæ* BOCOURT, Miss. Scientif. Mexique, Zool., III, livr. 8, 1882, p. 511.—COPE, Cat. Batr. Rept. C. Am. Mex., 1887, p. 64.—GARMAN, N. Am. Rept., Ophid., 1883, p. 7 (part only).

Charina plumbea (B. & G.).

1849.—? *Charina bottæ* J. E. GRAY, Cat. Spec. Snakes Brit. Mus., p. 113 (nec BLAINV.).

1852.—*Wenona plumbea* BAIRD & GIRARD, Proc. Philada. Acad., 1852, p. 176.—*Ibid.*, Cat. N. Am. Rept., I, Serp., 1853, p. 139.—GIRARD, U. S. Expl. Exp., Herpetol., 1858, p. 112, Atlas, pl. vii, figs. 1-7.—COOPER, Rep. Expl. Surv. P. R. R., XII, iii, 1860, p. 303.—JAN, Arch. f. Naturg., XXVIII, i, 1862, p. 247.—JAN & SORDELLI, Iconogr. Oph., Texte, 2 livr., 1865, p. 69 (3 livr., pl. ii, fig. 2).—BOCOURT, Miss. Scientif. Mexique, Zool., III, livr. 8, 1882, p. 512, pl. xxx, figs. 7-7c.—*Charina plumbea* COPE, Proc. Philada. Acad., 1861, p. 305.—*Id.*, *ibid.*, 1883, pp. 21, 23.—YARROW, Check List N. Am. Rept. Batr., 1883, p. 142.—TOWNSEND, Proc. U. S. Nat. Mus., x, 1887, p. 240.

1852.—*Wenona isabella* BAIRD & GIRARD, Proc. Philada. Acad., 1852, p. 176.—*Ibid.*, Cat. N. Am. Rept., I, Serp., 1853, p. 140.—GIRARD, U. S. Expl. Exp., Herpetol., 1858, p. 113, Atlas, pl. vii, figs. 8-14.

1883.—*Charina bottæ* var. *plumbea* GARMAN, N. Am. Rept., Ophid., 1883, p. 131.

Charina brachyops COPE.

1888.—*Charina brachyops* COPE, Proc. U. S. Nat. Mus., XI, 1888, p. 88, pl. xxxvi, figs. 2a-f.

Species.	Museum and No.	Collector.	Locality.	Scale rows.	Gastrosteges.	Urosteges.	Torals.	Prefrontals.	Internasals.	Anteorbitals.	Supraorbitals.	Postorbitals.	Suborbitals.	Labials in contact with eye.	Remarks.
<i>Ch. bottæ</i>	Paris.....	Botta.....	"California".....	39.....	202.....	30.....	1.....	4.....	2.....	1.....	1.....	3.....	0.....	3.....	Type spec. Jan & Boconrt auctt.
.....?	Brit. Mus.....	?	"California".....	.....	.....	..	2.....	4.....	0.....	3.....	3.....	3.....	+	0.....	Type of <i>Charina</i> . J. E. Gray auct.
<i>Ch. plumbea</i>	Paris.....	?	"Utah Terr.".....	43-45.....	192.....	30.....	1.....	5.....	0.....	2.....	1.....	3.....	2.....	0.....	Received from the Smiths. Inst.
Do.....	U. S. 4492.....	Expl. Exp.....	Puget Sound.....	45.....	206.....	37.....	0.....	4.....	0.....	1.....	1.....	3.....	2.....	0.....	Type of <i>W. plumbea</i> .
Do.....	U. S. 8922.....	Hemphill.....	Oakland, Cal.....	45.....	209.....	33.....	1-2.....	7.....	0.....	1.....	1.....	3.....	2.....	0.....	
Do.....	U. S. 9255.....	Kennerly.....	?	45.....	206.....	39.....	2.....	5.....	0.....	1.....	1.....	3.....	2.....	0.....	
Do.....	U. S. 11691.....	Ridgway.....	Nevada.....	45.....	208.....	36.....	1.....	5.....	0.....	1.....	1-2.....	3.....	2.....	0.....	
Do.....	U. S. 4499.....	Newberry.....	Oregon.....	45.....	201.....	37.....	1.....	5.....	0.....	1.....	1.....	3.....	2.....	0.....	
Do.....	U. S. 4497b.....	Trowbridge.....	Presidio, Cal.....	49.....	209.....	29.....	1.....	5.....	0.....	1.....	1.....	3.....	2.....	0-1.....	Ant. nas. do not meet.
Do.....	U. S. 4494.....	Suckley.....	Ft. Steilacoom, Wash.....	47-48.....	206.....	38.....	1-0.....	4.....	0.....	1-2.....	1.....	3.....	3-2.....	0-2.....	
Do.....	U. S. 4497a.....	Trowbridge.....	Presidio, Cal.....	45.....	195.....	34.....	1.....	4.....	0.....	1-2.....	1.....	3.....	1-2.....	1.....	Ant. nas. and ant. pref. fused.
Do.....	U. S. 9563.....	Henshaw.....	Eagle Lake, Cal.....	43.....	206.....	35.....	1.....	2.....	0.....	1.....	1.....	3.....	1.....	2.....	
Do.....	U. S. 12581.....	Bendire.....	John Day Valley, Oregon.....	45.....	208.....	33.....	1.....	5.....	2.....	1.....	1.....	4.....	0.....	2.....	
Do.....	U. S. 11789.....	Eisen.....	Fresno, Cal.....	45.....	211.....	36.....	1.....	4.....	0.....	1.....	1.....	3.....	0.....	2-3.....	Type of <i>W. isabellæ</i> . Ant. and post. prefrontals fused.
Do.....	U. S. 12566.....	do.....	do.....	43.....	204.....	34.....	1.....	4.....	0.....	1.....	1.....	3.....	0.....	2.....	A few urosteges divided; frontal divided longitudinally.
Do.....	U. S. 7299.....	Expl. Exp.....	Puget Sound.....	45.....	210.....	34.....	1-0.....	3.....	0.....	1.....	1.....	3.....	0.....	3.....	A few urosteges divided; ant. nas. and ant. pref. fused.
Do.....	U. S. 16148.....	Johnson.....	Seattle, Wash.....	43.....	206.....	31.....	1.....	5.....	0.....	1.....	3.....	2.....	3.....	0.....	Ant. nas. and ant. pref. fused.
Do.....	U. S. 16149.....	do.....	do.....	43.....	200.....	36.....	1.....	4.....	0.....	1.....	1.....	3.....	2.....	0.....	Type.
Do.....	U. S. 16150.....	do.....	do.....	43.....	203.....	35.....	1.....	4.....	0.....	1-2.....	1.....	2-3.....	2.....	0.....	
Do.....	U. S. 16151.....	do.....	do.....	45.....	201.....	37.....	1.....	5.....	0.....	2.....	1.....	1-3.....	1-2.....	1.....	
Do.....	U. S. 16152.....	do.....	do.....	43.....	203.....	35.....	1.....	5.....	0.....	1-2.....	1.....	3.....	1-0.....	2.....	
Do.....	U. S. 4496.....	Trowbridge.....	Humboldt Bay, Cal.....	45.....	206.....	34.....	1.....	5.....	0.....	1.....	1.....	4-2.....	1.....	2.....	
<i>Ch. brachyops</i>	U. S. 15524.....	Merriam.....	Cape Reyes, Cal.....	45.....	.....	.....	0.....	4.....	2.....	1.....	1.....	3.....	0.....	3-4.....	

ON THE NORTH AMERICAN LIZARDS OF THE GENUS *BARISSIA*
OF GRAY.

BY

LEONHARD STEJNEGER.

Curator of the Department of Reptiles and Batrachians.

Barissia imbricata (WIEGM.).

Since Professor Baird, in 1858, described his *Gerrhonotus olivaceus* very little has been done with a view to determine its relation to the other species of the genus. Cope (Bull. U. S. Nat. Mus., No. 1, pp. 46, 90) recognizes it as a separate species peculiar to the Pacific region, and Yarrow (Bull. U. S. Nat. Mus., No. 24, p. 46) and Garman (List. N. Am. Rept. and Batr., p. 13) follow his example, the former identifying two [or, correctly, three] specimens in the National Museum (No. 7087) from Mexico as this species, thus including the latter country within the range of the species. Boulenger (Cal. Liz. Brit. Mus., II, p. 273) includes it among the synonyms of *Gerrhonotus caeruleus*, though with a query, a most remarkable proceeding, since the original description of Professor Baird clearly indicates it as a member of the *Barissia* group, whether this name be taken in a generic sense, or not, as will be seen from the following quotation:

No single frontal [= "no azygos prefrontal"]. A series of three pairs of plates between the vertical [= "frontal"] and rostral * * * 39 transverse rows of scales on back from head to tail. 12 longitudinal rows above; the 6 central strongly carinated.

No mention is made of "projecting scales above the ear", a character which Professor Baird would most probably have noted had it occurred in his specimens. Applying this description to Boulenger's own synopsis of the species of the genus *Gerrhonotus* (*tom. cit.*, p. 267), it will be seen that it falls within the characters assigned to *G. imbricatus*. An examination of Baird's type also proves most conclusively that *G. olivaceus* is a synonym of *Barissia imbricata*.*

The specimens in hand, Professor Baird's types (U. S. Nat. Mus., No. 3096), and three from Orizaba, collected by Sumichrast (No. 7087) agree in every respect *inter se*, as well as with Wiegmann's, Bocourt's, and Boulenger's descriptions of the typical *G. imbricatus*. In the arrangement of the cephalic shields, in the carination and numbers of dorsal

*Garman in his "List" (*l. c.*) places *G. olivaceus* in the genus *Barissia*, retaining *imbricatus* in *Gerrhonotus*. I can see no good reason for this, inasmuch as the latter species seems to be the type of the genus *Barissia*.

rows, in proportions and coloration there seems to be no essential disagreement, in proof of which I have appended below a table of some of the characters which can be expressed in a statement of that kind.

The alleged locality of the types can hardly be accepted as an objection to this identification. In Yarrow's catalogue of the specimen's in the U. S. National Museum (Bull. No. 24, p. 46) the locality is given as "San Diego, Cal.," and Cope (*ll. cc.*) also attributes *B. olivacea* to southern California. I doubt very much the correctness of this for various reasons. In the first place the locality given in the original description is only "near San Diego," and this is also the way it is written in the Museum record-book, and I think it is impossible to say with certainty now whether this San Diego is the city located in southern California or one of the several other places of the same name in the neighborhood of which the gentlemen connected with the U. S. and Mexican Boundary Commission collected specimens for the Smithsonian Institution. It is true that "Cal." is interpolated after San Diego in the report of the Boundary Survey, but that may have been nothing more than an "editorial" correction made without consulting the records. Even if "San Diego, Cal." had been intended originally, it does not follow that the specimens were collected *very* "near" that place. The locality of *G. webbia* described only a few lines above *G. olivaceus* is also given as "near San Diego, Cal.," but if we turn to the original record in the Museum register we will find that No. 3078 was collected "From San Diego to El Paso," a distance of more than six hundred miles, as the crow flies.

Specimens examined.

United States National Museum No.	Locality.	Collector.	Nuchal scales, longitudinal rows.	Dorsal scales, longitudinal rows.	Dorsal scales, transverse rows.	Ventral scales, longitudinal rows.	Snout to vent.	Snout to ear.	Snout to fore limb.	Axil to groin.	Fore limb.	Hind limb.
3096a	"Near San Diego."	A. Schott ...	8	14	40	12	mm. 100	21	35	57	25	32
3096b	...do	...do	8	14	38	12	80	17	27	43	20	25
7087a	Orizaba, Mex.	Sumichrast	8	14	39	12	112	27	37	63	28	...
7087b	...do	...do	8	14	39	12	93	22	32	50	24	33
7087c (juv.)	...do	...do	8	14	41	12	45	11	16	24	12	15

Barissia levicollis, sp. nov.

DIAGNOSIS.—No zygotes prefrontal; three pairs of shields between the frontal and the rostral; prefrontals not in contact with loreal; no projecting scales above the ear; one large upper postorbital and two minute lower ones; forty-six transverse rows of dorsal scales between the head and the base of the tail, and sixteen longitudinal rows; head shields swollen.

HAB.—"Mexican boundary."

Type.—U. S. Nat. Mus., No. 9362.

Description of type specimen.—Head narrow, snout long, pointed; head shields swollen; two pairs of internasals, the posterior in contact with anterior supraocular; one pair of prefrontals; nasal separated from rostral; a supranasal; a postnasal; a loreal, pentagonal, not higher than wide, and separated from prefrontals; a preorbital; two suborbitals, the posterior very long; one very large upper postorbital and two minute lower ones; ten and twelve supralabials; sides of neck covered with granular scales; lateral fold, commencing below the ear opening; nuchal scales not keeled, in ten longitudinal rows; dorsal scales of medium size, in sixteen longitudinal rows, the four median obtusely keeled, the next two on each side with the keels still less pronounced and the remainder smooth; forty-six transverse dorsal rows; ventrals smaller than dorsals, in twelve longitudinal rows; [tail reproduced].

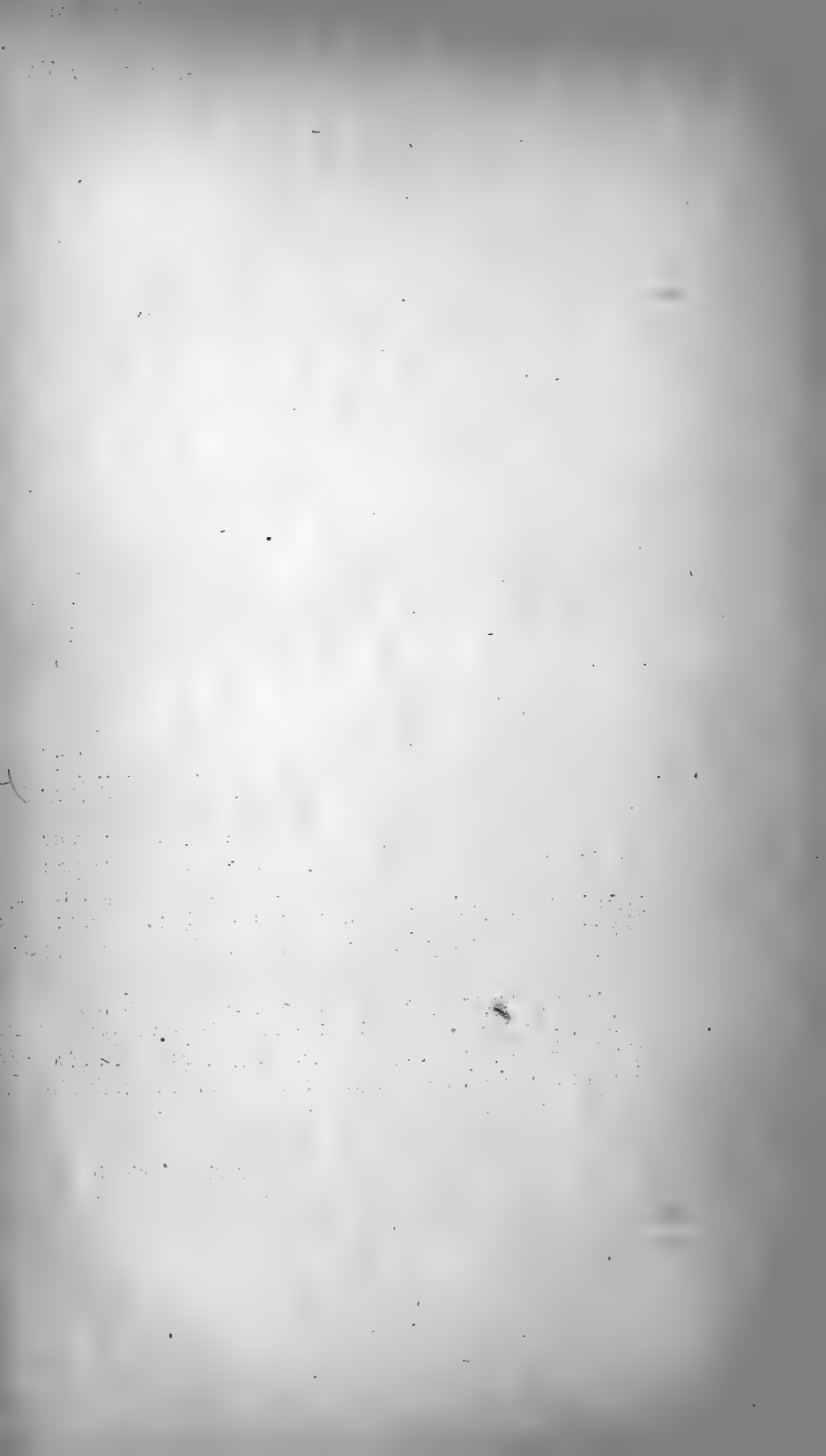
Color (in alcohol) above uniform "tawny-olive" with interrupted transverse bands of black dots on the sides, the scales with the dots being margined posteriorly, more or less distinctly, with whitish; under side dull pale clay-color, with irregular black dots on flanks and throat.

Dimensions of type.

	Millimeters.
From snout to vent.....	121
From snout to ear opening.....	27
From snout to fore limb.....	38
From axilla to groin.....	67
Greatest width of head.....	18
Fore limb.....	27
Hind limb.....	34

Unfortunately, the exact locality where the type of this species was collected is not known; all that the record book contains is "Mexican Boundary." It was evidently obtained by one of the surveying parties of the United States and Mexican Boundary, but the original number having become obliterated, it was re-entered in 1877 and the original label—or what remained of it—destroyed.

The present species belongs to the same group as the foregoing, having "three pairs of shields between the frontal and the rostral," or in other words, "two pairs of internasal scuta." It differs from *B. imbricata*, however, in the greater number of dorsal rows, both longitudinal and transverse; in the obsolete carination of the dorsal scales; in the exclusion of the loreal from the prefrontals; in the smaller size and greater number of the temporals, and in the narrower and more elongated shape of the head. It has the sixteen longitudinal rows of dorsals in common with *B. planifrons* BOCOURT, but the head shields are swollen and the other characters which separate it from *B. imbricata* also distinguish it from *B. planifrons*. *B. rudicollis* is still farther removed by the low number of the transverse dorsal rows, the strong carination of the nuchal shields, and the contact of the nasal with the rostral.



A COLLECTION OF STONE IMPLEMENTS FROM THE DISTRICT OF COLUMBIA.

BY
S. V. PROUDFIT,
Department of the Interior.

(With plates x-xiv.)

The collection of stone implements from the District of Columbia and its environs, which is herewith presented to the Smithsonian Institution as an addition to the donation of December 22, 1887, is the result of personal work in the field. It was not made with a premeditated donative intent, but has grown by degrees until the collector no longer feels justified in claiming or exercising the right of sole ownership therein. In the hands of the Institution it will not only be accessible to others who are interested in such matters, but will probably draw to it further contributions from the same area, and thus serve a better purpose than it possibly could in private possession.

The collection is fairly typical of the aboriginal work as it is now found in the fields of the District. The greater part of the large stone implements had found its way into public and private collections long before this one began, hence the number of polished implements now offered is comparatively small. Yet, while this is true, a sufficient number of these implements have been found to fairly exhibit the degree of skill attained by the Potomac Indian in this class of work.

A tribute here to the handicraft of this people is not misplaced. The material with which they wrought was the most obdurate and refractory of all substances found available to any considerable degree among the American Indians. Quartz, quartzite, and argillite for the greater part were used from necessity, no better material being within reach. The first two are very hard, and in the hand of the workman full of unpleasant surprises. A long, slender flake, such as might be easily driven off from a mass of flint or obsidian, could be but with great difficulty produced from the boulder or pebble of the Potomac gravels. The argillite, though softer, is not susceptible of receiving or retaining any high degree of finish. Notwithstanding these obstacles the material was treated with such patience, care, and skill, that the work of this region, not only in matters of utility but in points of finish compares favorably with that of any other.

In gathering these relics special care has been taken to preserve an accurate record of each addition to the collection, so that, if it were desired, every piece might be replaced in the very field from which it was obtained; and in order that the record and catalogue may be better understood and perpetuated, as against the ultimate result of the growth of the city and continued cultivation of the fields, a map has been prepared and is submitted herewith, whereon are marked the various fields from which the collection was made. The map will also serve to show the location of all Indian village sites and aboriginal workshops in the District, and from what part of each contributing village site the collection was gathered. Thus it will be seen by consulting the map (Plate x,) that the eastern shore of the Anacostia, or Eastern Branch of the Potomac, is dotted with wigwam-like marks to indicate a village site, while but three fields on the stream are marked from which relics have been taken; one at Anacostia marked A, and two at Bennings marked B and C. The village is old Nacotchtanke, which stretched along the whole eastern shore from the mouth of the stream up to Bladensburg. While many places along the eastern shore of the Anacostia, are equally rich in relics as the three indicated, the ease with which the latter are reached from the city accounts for their marked prominence in this collection.

Again, it will be noticed that a village site is laid down along the eastern bank of the Potomac, from a short distance above Georgetown to the Little Falls, while but two fields, D and E, are there marked as having contributed to the collection. In this case the other fields were not available to the collector, being either covered with a heavy sod, or so closely cultivated that no room was left for the antiquarian. A small village is marked on the Virginia shore of the Potomac, overlooking Chain Bridge and Little Falls; another at the foot of Anacostan Island, on the same side of the stream; and still another a little farther down, at the southern end of the Long Bridge (Namaraugh quena); one at the mouth of Four Mile Run; and one at Falls Church, on the same stream.

It should not be understood that any one of these sites or fields has been exhausted by the collector. The ground covered by the village sites has been but partially under search, and the search even where it has extended has not been prosecuted closely enough to appreciably diminish the amount of relics, except in the matter of large stone implements, such as would strike the attention of those cultivating the fields, and so find their own way into public and private collections. In fact, the amount of material that may yet be gathered from these village sites is only emphasized by the present collection, which in effect is substantially confined to the fields at Bennings.

With each plowing of the fields a fresh supply of relics is turned up for the collector, and how long this will hold good may be indicated in the following observation: The new bridge across the Anacostia at the

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MAP OF THE DISTRICT OF COLUMBIA, SHOWING ANCIENT VILLAGE SITES, ETC.



eastern end of Pennsylvania avenue leads directly into one of the old camps of Nacotchtanke. In preparing the grade for the eastern approach to the bridge, the surface soil was removed from at least two acres of this camp. The field, a level sandy plain, was first plowed, the loose soil taken up and deposited on the grade, and the process repeated. Each time the shovel followed the plow nearly everything turned up by the latter was removed from the field. On one side of the field, however, the work was not carried out to include the full area first laid bare, but was confined within lesser limits, and, the same thing occurring again, two low terraces were formed, each but a little more than the depth of one plowing. Thus: the upper terrace is the original surface of the field, the next lower the result of the first plowing, and the foot of this terrace the result of the last plowing. The whole depth of the excavation at this point was a little over two feet. An examination showed that the upper terrace carried a large number of relics common to the locality, bits of worked quartz, quartzite, arrowheads, etc., the second an equal quantity of the same material, while the bottom, though in less degree, still furnished a considerable number of implements, fragments, and chips.

To illustrate the amount of material on the surface of the ground, attention is directed to Exhibit No. 146,563, a tray of 107 pieces picked up in two hours' work, April 20, 1888, from the field marked A: A polished ax, arrowheads, knives, scraps of pottery, etc.; all the odds and ends of the old village life.

In studying the distribution of stone implements in the District it should be remembered that an Indian village of the Potomac was not a compact assemblage of houses, but scattered dwellings along a water-course, with the intervening spaces usually under cultivation. In some instances, however, a cluster of houses might be found at such points as afforded more than the ordinary riparian advantages, but usually the dwellings were comparatively isolated. Again, the establishment of temporary hunting and fishing stations is to be taken into consideration. An examination of any cultivated field that lies along the Potomac or Anacostia will furnish more or less evidence of temporary occupation. The difference between these places and village sites is readily discernible in the character of the remains, as well as in the quantity. The former show flakes, and chips of stone, with here and there an implement of the knife and arrowhead type, while the latter, with its ever-present pottery, seems to have left its mark on every stone in the field. The wreck of an old village can never be mistaken for the camp-ground of a single season.

In addition to the implements found in the vicinity of villages and hunting camps, the occasional arrowhead lost in the chase, and the greater number spent in battle, should not be overlooked.

After an engagement with the Mannahocks, it is related by Capt. John Smith that "we contented Mosco (a friendly Moraughtacund) in

helping him to gather up their arrowes, which were an armefull, whereof he gloried not a little.”*

In passing over the fields of the district, the frequent occurrence of a few chips of quartz, or quartzite, at places which do not otherwise show any signs of occupation, calls to mind another statement by Smith concerning the readiness with which the Potomac Indian prepared an arrowhead for use.

His arrowhead he quickly maketh with a little bone, which he ever weareth at his bracer, of any splint of a stone or glasse in the forme of a hart; and these they glew to the end of their arrows.*

The term “arrowhead,” as generally used, is applied to an implement with a range of usefulness much wider than is suggested by the word itself. It is a conventionalism, descriptive as to form, but not as to use. Wherever a sharp, cutting edge or point is required, either as the tip of an arrow or the blade of a knife, the general form is the same. By its wedge-shaped butt, or barbed shank, the point is easily secured in place to serve the purpose of the hour.

In the evolution of the arrowhead, invention confined itself mainly to methods of hafting, and in this direction much ingenuity is displayed in the variations of shank and base. It may be said with truth that the arrowhead, considered in its use as a projectile, reached its perfection in the hands of primitive man, so far as form goes, and that only in the matter of material was the point of the English archer’s arrow superior to that of the American Indian.

That it was only after protracted use of the simpler forms that the perfected arrow point was secured, goes without argument, but that we can show the stages of this evolution is another and more doubtful matter.

The reason for this lies in the fact that the most highly finished arrowhead must of necessity pass through the ruder forms in the process of manufacture, so that if work on the modern arrowhead is suspended before the implement is finished, we have an archaic type of the same implement. The remains of an old village site will illustrate this statement. From the chipped pebble without definite form, to the rudely ovate point, and from that stage to the thin blade, all may be found mingled together. Here rudeness in form is no evidence of antiquity, it being but a necessary incident in the production of the implement in any age. Catalogue No. 146651, U. S. National Museum, a tray of eighteen quartz pieces, with flakes and chips, from the fields at Bennings, will serve as an illustration.

The course of any chipped implement, whether arrowhead or knife, from the rock in mass to completion is the same. At each stage of successive chippings the stone assumes the familiar forms which have often been mistaken for completed implements of a rude type and great

* Smith’s Works, vol. 2, p. 427, Arber’s ed.

* Ibid., vol. 1, p. 68.

antiquity. To secure a knife of the larger variety the employment of a stone of considerable size is necessary to allow for the waste in working, and this fact should not be overlooked in determining the true character of certain forms of primitive work found in the district and elsewhere.

In confirmation of these conclusions, attention is asked to Nos. 146589 to 146616, forty-five pieces from various fields of the district and vicinity. Also Catalogue Nos. 146572-146604, U. S. National Museum, a tray of thirty-four pieces from the same fields.

These three exhibits comprise the various materials commonly employed for chipped implements, and in each substance the methods of treatment, as discovered from the unfinished implements, serve to emphasize the primal forms of the knife or arrowhead as it emerges from the pebble or rock in mass. In many cases the untouched crust of the pebble shows here and there on the face of the unfinished piece; in some the work is only begun; in others it is nearly finished; in most cases abandonment of the original intention is suggested, if not actually apparent. But on the other hand, many of these apparently unfinished pieces are as well calculated in their present form, if not better, to serve certain purposes than if more finely wrought; so that the separation of the finished from the unfinished implements can not be effected with any great degree of exactness, a rough and jagged point of stone, set in the knotted end of a club adds more to the savage effectiveness of the weapon than a polished stone would, though formed for the same purpose. But the same jagged point with a few well-directed touches can be reduced to a cutting tool, capable of many uses, yet it is quite as much a finished piece in the first form as in the last. This again suggests the futility of accepting form as indicative of antiquity in the line of chipped stone implements, especially when it is seen that the ruder forms are constantly repeated and perpetuated in the latest efforts of the stone worker.

The persistent survival of essentially primitive types, under the pressure of changed conditions, also adds an element of confusion to the labor of classification.

In the Ray collection from the Hupa Reservation,* jasper knives are shown that were found in actual use in 1885. The form of the blade is identical with the leaf-shaped knife of the Potomac. The hafting is effected by setting the butt of the blade in the slit end of a short pine stick and the liberal use of pitch. In some instances the handle is formed of two pieces lashed together, and in one specimen of this kind the lashing used is ordinary *cotton twine*. The aboriginal conception of the implement remains unchanged, though the bit of cotton string unites it to the present with startling effect.

A suggestion the reverse of this is found in a curious thing set down in Smith's account of the relations existing between the Jamestown col-

*Prof. Otis T. Mason, Smithsonian Report, 1885, Part 1, pages 205-239.

ony and the people of Powhatan. Inquiry being made as to Smith's intended movements he answered :

We sent him word we intended no such thing (an invasion) but only to goe to Powhatan (the country) to seek stones to make hatchets ; except his men shot at us, as Paspahugh had told us they would ; which if they did shoote but one arrowe, we would destroye them, etc.

Now did Smith tell the truth ? Did the colony in fact make stone implements in exchange for the products of the Indian fields, or did he merely assign a cause for his intended trip which would appear reasonable to the Indians ? Whatever the truth may have been, it is to be hoped that the statement proved more satisfactory to the Indian than it does to the archæologist now.

This much however of valuable suggestion is found in the Smith incident. The Indians of the Powhatan Confederacy were accustomed to frequent certain places for the purpose of obtaining suitable material for their tools and weapons, and the fact was well known to the colonists. In short, the place thus indefinitely designated by Smith may be accepted as a *historic* "workshop," for the practice of reducing the rough material to at least primary forms at the place where it was found seems to have been generally followed.

Workshops were established where abundance of material was found in conjunction with special conveniences for working it, such as nearness to water, etc. The materials most available were quartz and quartzite, and these were to be had from the gravel beds of the valley. That the pebble, or small boulder, was used instead of the rock in mass is easily to be seen from any series of chipped implements made of these materials. It does not follow, however, that surface pebbles were used. The Indian well knew that the stone fresh from the ground worked better than the sun-baked stone, and it is quite probable that he took pains to secure the former, though absolute proof of such practice in the District is yet wanting.*

A place possessing all the requisites for an Indian workshop is found on Piney Branch, a small stream that enters Rock Creek on the outskirts of Mount Pleasant. On the north side of the branch, and just below where it is crossed by Fourteenth street road, Blagden's hill rises abruptly from the bed of the stream, a steep gravelly hill, with its sides and summit well covered by native forest trees. Here, over a space of several acres, lie scattered the chips, flakes, and chipped stones left by the native workman as the arrow-head and knife grew under the deft touch of a practiced hand. The ground in places is literally covered with this work. Some stones show but a single fracture, while others are fashioned into the rudé subovate forms, so familiar on the village site. One of the most common forms is the split pebble with its outer face worked at the edges and the center untouched ; and another not

*This paper was written before Mr. Holmes's exploration of the Piney Branch workshop. (See "The Anthropologist," Vol. 3, No. 1, p. 1 ; also, Vol. 2, July, 1889, pp. 241-246.)

infrequently found is the "domestic hand-ax,"* a pebble with one end roughly chipped to an ax-like edge. These rude forms, together with the chips and flakes, make up for the most part the great mass of remains, but here and there occur the butts and tips, and occasionally a perfect specimen of the leaf-shaped knife. (See Figs. Plates IX-XIV.) No pottery is found, and but three arrow-heads have thus far rewarded the search of the writer. (Cat. No. 146571, U. S. Nat. Mus.) These were found at the foot of the hill and are made of argillite, while the other work is in quartzite, the pebbles of which in main constitute the gravel beds of the hill.

On the level at the top of the hill may be seen small patches of ground littered with the smaller chips, among which have been found quite a number of the tips and butts of knives. A deep ravine with a small stream at the bottom cuts the hill about midway, and in the bed of this stream, as well as that of the branch, the *debris* occurs in abundance. The sides of the ravine furnish an exposure in places of several feet, and from the face of this exposure the writer has taken chipped stones that were under four feet of soil and gravel. The same thing and under like conditions may be observed along the bank of the branch where it has been cut away by the action of the water.

At the foot of many of the trees standing on the hill-side are considerable accumulations of chips, with worked and unworked stones, that have drifted down the hill till intercepted by the base of the tree.

These observations have been confined to the remains and the conditions under which they are found on the north bank of Piney Branch and below the Fourteenth-street road; but similar work, though in less quantity, is found on that part of the hill above the road, as well as on the south side of the branch and opposite Blagden's hill. Along the banks of Rock Creek, below Piney Branch, other workshops have been located, though not covering so large an area or showing an equal amount of work in the same space. One of these, however, on the west side of the creek and just above Oak Hill Cemetery, will doubtless make as good returns under the same exploration as the larger shop on the Piney Branch. The grading on the east side of the creek during the past year has so modified the original topography of that bank and the adjacent hills that but little remains now to be seen of places that once furnished considerable evidence of aboriginal work in stone.

The collection from Piney Branch is made up of unfinished implements, forty pieces; butts and tips of knives, thirty-one pieces; rude implements, cores, etc., twenty-seven pieces; and a box of flakes and chips. (See catalogue.) The work from this place should be compared with that from the village sites. The wonderful similarity of corresponding series (a similarity which renders the substitution of one for

*See Abbott's Stone Age in New Jersey.

the other a matter not to be detected by the expert) can not fail to suggest how small a place mere form has in settling the antiquity of a chipped stone implement.

ARROW-HEADS.

An effort toward the classification of the arrow-heads found on the village sites has been made, and though it is only tentative and based upon arbitrary conventionalities in form, it may be useful in calling attention to the many variations possible in so small a matter as the method of attaching the point to the shaft, or the blade to the handle. The classification is made upon the base line of the arrow-head and the form of the butt or shank. The forms, however, frequently blend, and vary from one shape to another, with such slight shades of difference that an attempt to classify them on any basis of form would be worse than idle.

Some beautiful pieces in quartz and quartzite are shown. Long slender tips, with symmetrical edges, and carefully wrought shank.

Imported material, flint, jasper, and chalcedony, occasionally appears in the collection.

AXES, CELTS, ETC.

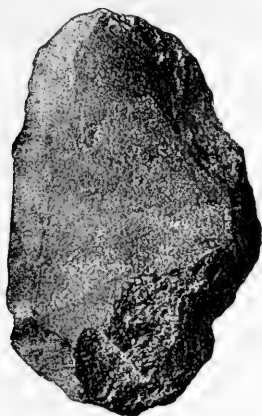
A few fine specimens are submitted; the most are, however, not worthy of special mention, though the whole collection in this class is perhaps a fair illustration of the handicraft of the Potomac Indian. Special attention is asked to the descriptive catalogue herewith.

POTTERY.

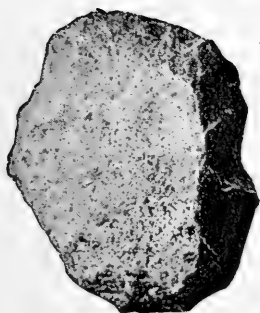
One box of sherds from the fields at Benning's comprises the exhibit of pottery. The long continued cultivation of the ground has gradually reduced the pottery to such small fragments that the shape and size of the original vessel can but rarely be determined. But from the small pieces now obtainable, the material used, the method of tempering the clay, and taste in decorative art, may be readily learned.

SOAP-STONE VESSELS.

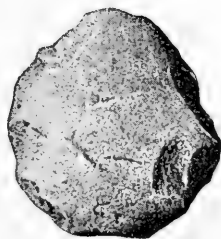
The last four numbers in the catalogue are from a soap-stone workshop located on Four-Mile Run, and about one mile below Falls Church. A considerable amount of the material was found at this place, but the greater portion of it showed but slight evidences of artificial handling. The supply was doubtless from a point a short distance above the workshop, where in late years the stone has been quarried to some extent. No indications of aboriginal mining however remain at present.



a



c



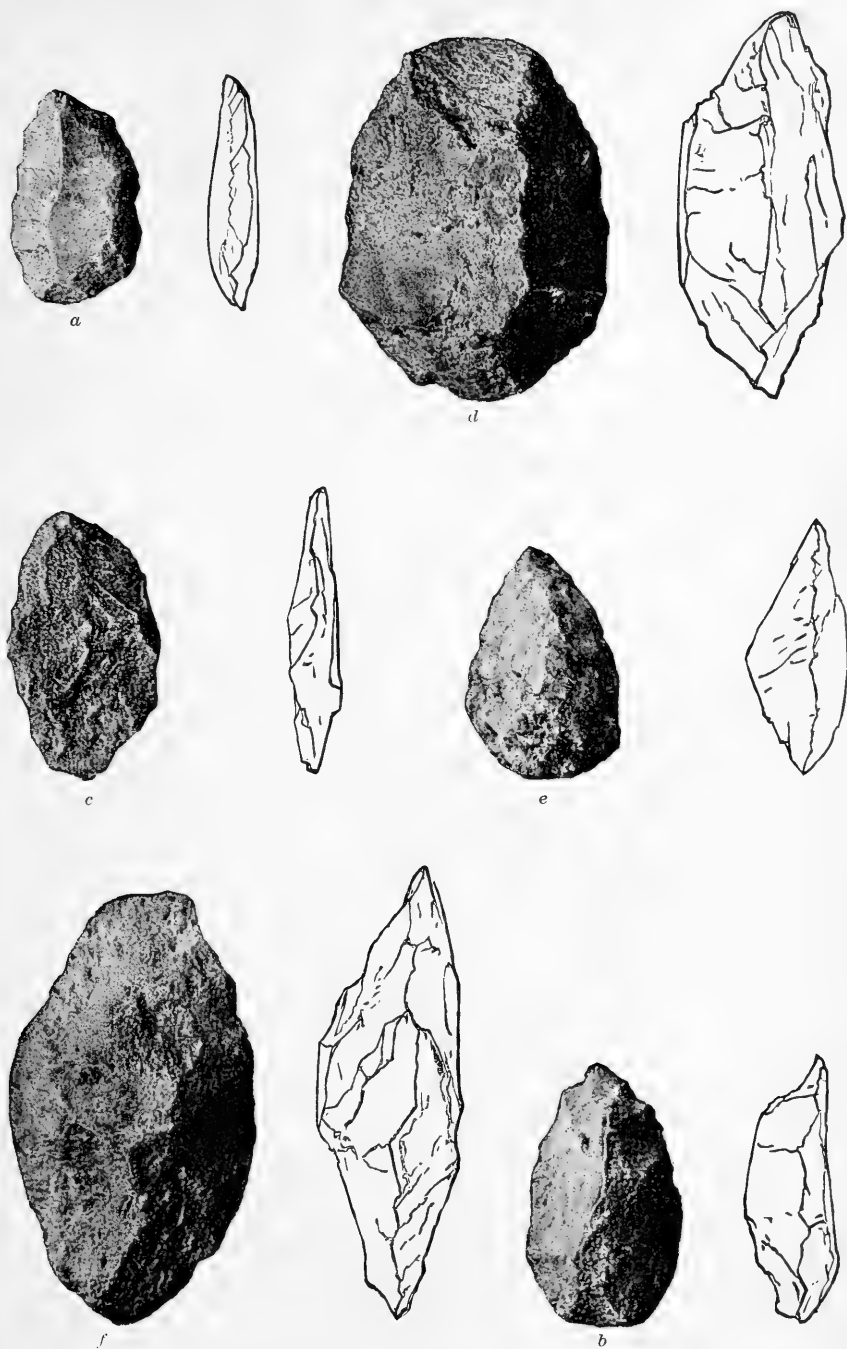
d



b



RUDE CHIPPED IMPLEMENTS FROM THE DISTRICT OF COLUMBIA.
(Half natural size.)



RUDE CHIPPED IMPLEMENTS FROM THE DISTRICT OF COLUMBIA.
(Half natural size.)



a



b



c



d

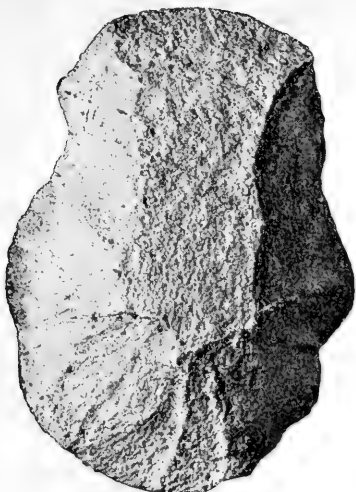


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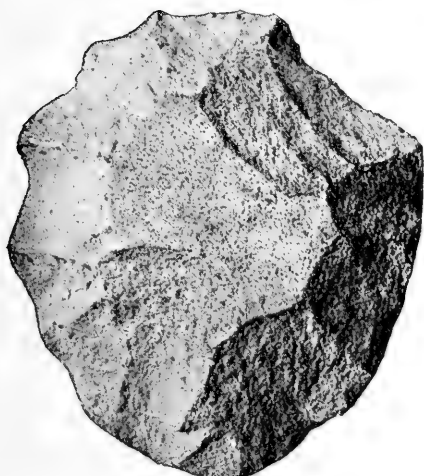


e

PALEOLITHIC IMPLEMENTS FROM THE DISTRICT OF COLUMBIA.
(Half natural size.)



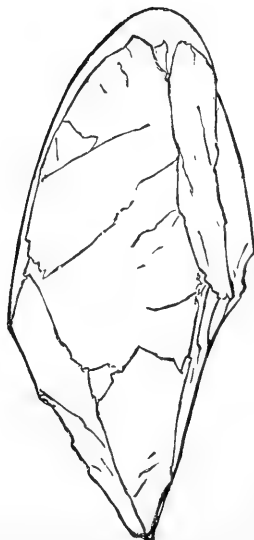
a



b



c



PALEOLITHIC IMPLEMENTS FROM THE DISTRICT OF COLUMBIA.
(Half natural size.)

NOTES ON THE OCCURRENCE OF A YOUNG CRAB-EATER (ELACATE CANADA), FROM THE LOWER HUDSON VALLEY, NEW YORK.

BY

A. K. FISHER, M. D.,

Department of Agriculture.

Although the adult Crab-eater, Cobia, Ling, or Coal-fish, as the species is variously designated, has been well known for a long time, the young, strange to say, has escaped notice until recently. During the summer of 1887, Dr. Tarleton H. Bean made a study of the fishes of Great Egg Harbor Bay, New Jersey, and among various things discovered was the long-sought young of this species. In the report on the collection (Bull. U. S. Fish Com., VII, 1888, 144) he describes two individuals which were captured August 2 and August 23.

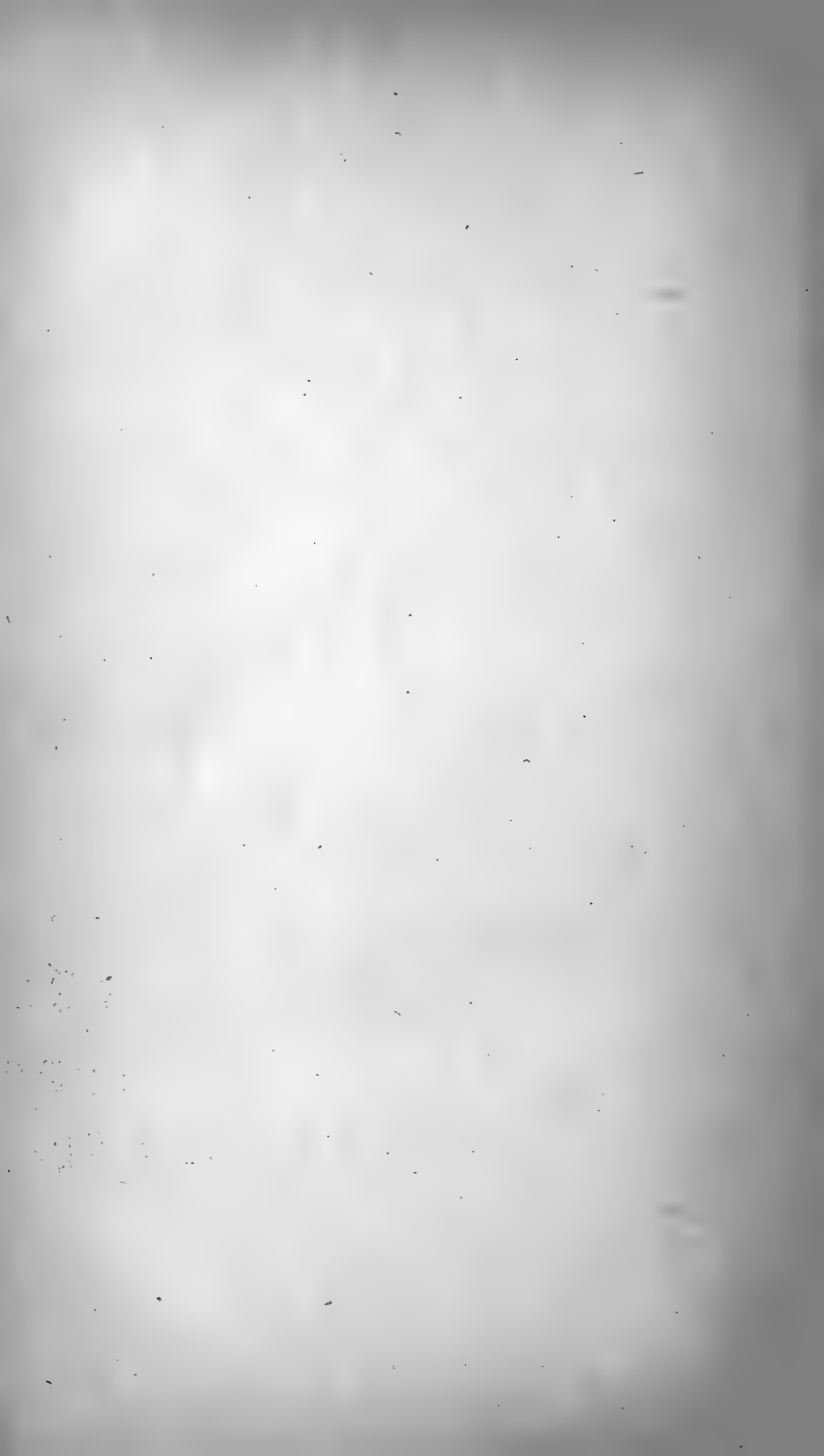
The most striking difference between the adult and young fish, irrespective of size, is the shape of the caudal fin, which in the former is deeply forked and in the latter uniformly rounded. In June, 1876, nearly eleven years before Dr. Bean captured these specimens, the writer received a young fish of this species, measuring 95^{mm} in length, from a fisherman who caught it in a minnow seine about 1 mile north of the village of Sing Sing, New York, in the broad and shallow cove formed by the expansion of the Croton River as it enters the Hudson.

The occurrence of this fish in the lower Hudson River, taken in connection with the many austral forms of mammals, birds, reptiles, batrachians, insects, and plants which grow along its banks, shows how decidedly southern are the fauna and flora of the southern portion of New York State.

The river seems to be about the northern limit of its distribution, although adults are occasionally taken off Cape Cod, and once a specimen was captured in Boston Harbor.

The species inhabits the warmer portions of both oceans and extends north along our eastern coast regularly to the Chesapeake. Nothing could be learned of the habits of the young fish further than it was alone, as were Dr. Bean's specimens, so, presumably, they must soon separate and lead a solitary life, as the adults are said to do. The Crab-eater is very voracious, feeding extensively on crabs and the smaller fish, hunting its prey much after the manner of the pike.

Specimens are taken that measure 1½ meters (5 feet) in length, and weigh nearly 10 kilograms (20 pounds); hence the Crab-eater is entitled to prominence as a food-fish, not only on account of the delicate flavor of its flesh, but also for its suitable size.



OBSERVATIONS ON THE LIFE HISTORY OF THE BOTTLENOSE PORPOISE.

BY

FREDERICK W. TRUE,

Curator of the Department of Mammals.

In the spring of 1886 I was requested by Professor Baird to investigate and report upon the porpoise fishery carried on at Hatteras, North Carolina. Some account of the fishery, in its industrial aspects, has already been published in the Bulletin of the U. S. Fish Commission.* I now desire to supplement that account by recording some observations which I made regarding the habits and structure of the porpoises themselves.

I reached the station in the middle of May and found that the fishing season was nearly at its close. Nevertheless active operations were still in progress, and several large hauls were made during my stay. I was hospitably entertained by Colonel Wainwright, who was in charge of the fishery, and from him as well as from the fishermen I gathered many interesting facts.

The species captured at Hatteras is *Tursiops tursio* (Bonnaterre). To the fishermen it is known simply as the porpoise.† The species is common along the entire Atlantic coast of the United States from Maine to Florida, and along the Gulf coast at least as far as Texas. It enters the Chesapeake Bay, and I have been informed that it occasionally ascends the Potomac River as far as Glymont, a fishing station on the Maryland shore, about 18 miles below Washington. I have never seen it myself, however, beyond Fortress Monroe, at the entrance of the bay.

For several days after my arrival at Hatteras no porpoises were taken and I began to fear that the season was closed. On the 14th of May, however, a school approached from the south, and the nets being cast, forty porpoises were taken. Of these twenty-six were males and fourteen females. The majority were full-grown individuals, and the smallest in the school had well-developed teeth. The largest individual measured 9 feet 10 inches in a straight line, and the smallest, 6 feet 7 inches.

* Vol. V, p. 3.

† Prof. Van Beneden, in his recent work on the Natural History of the Dolphins of Europe, states that the English call this species the "Bottlenose whale." This is, I believe, erroneous. The name Bottlenose whale is applied to *Hyperoodon*. (Hist. Nat. Delphinides des mers d'Europe, 1889, p. 178. Extr. Mém. Couron. de l'Acad. roy. de Belgique, XLIII.)

I measured the total length of eleven individuals of this school, including the two already mentioned, as they lay together on the beach; also, in eight cases, the length of the pectoral fin, or flipper, in a straight line along its center. The dimensions were as follows:

	Total length.		Length of flipper.
	<i>Feet.</i>	<i>In.</i>	<i>In.</i>
1	8	2	13
2	6	7	10½
3	8	11	14
4	9	5	14½
5	8	10	14½
6	7	4	12
7	8	7	14
8	9	0	14½
9	9	5	
10	9	9	
11	9	10	

The average length in this school was about 9 feet.

On the next day a second haul was made and twenty porpoises were captured. Of these ten were males and ten females. The largest individual measured 9 feet 4 inches in a straight line, and the smallest 5 feet 4 inches. The majority, however, as in the previous haul, were about 9 feet in length.

The nets were run out a second time on the same day, and the catch consisted of seventeen porpoises, of which nine were males and eight females.

After this time no more porpoises came sufficiently near the beach to enable the fishermen to encircle them with their nets, until May 19. Two hauls were made on that day. As a result of the first, fourteen porpoises were captured, of which six were males and eight females. I measured the total length of each, with the following result:

	Sex.	Total length.	
		<i>Ft.</i>	<i>In.</i>
1	Female	3	7
2	Male	4	5
3	Female	5	8
4	Male	6	2
5	Male	6	4
6	Male	7	2
7	Female	7	9
8	Female	7	10
9	Female	8	0
10	Female	8	1
11	Female	8	3
12	Female ..	8	6
13	Male	9	2
14	Male	9	3

All the females except the two smallest ones were in milk.

In the first two individuals included in this table the teeth had not cut through the gums.

When the nets were run out a second time on the same day sixty-six porpoises were taken, of which thirty-one were males and thirty-five females. These were mostly full-grown animals, having a length of about 8 feet. The largest measured 8 feet 5 inches, and the smallest 5 feet 3 inches. In the latter the teeth had pierced the gums. Nine of the females were in milk.

I have summed up in the following table the number of males and females taken in each haul, and the size of the largest and smallest individuals:

Date of haul.	Total No.	Males.	Females.	Largest.		Smallest.	
				<i>Ft.</i>	<i>In.</i>	<i>Ft.</i>	<i>In.</i>
May 14	40	26	14	9	10	6	7
May 15:							
First haul	20	10	10	9	4	5	4
Second haul ...	17	9	8				
May 19:							
First haul	14	6	8	9	3	3	7
Second haul....	66	31	35	8	5	5	3
Total	157	82	75				

Upon examining the figures in this table one is led to remark, first, the nearly equal division between the two sexes of the individuals in each group except the first; and, secondly, the great disparity in size and age among the individuals of each group.

In considering the bearing of these facts it should be remembered that the observations were made at the close of what the fishermen believe to be a northward migration. At such a time it is to be supposed that all the individuals, whether young or old, male or female, which had remained behind from various causes, would move northward together. The usual composition of the various herds or "schools" might be disturbed. The fishermen were of the opinion that such was the case. They stated that earlier in the season the schools were more homogeneous as regards age and sex, and that they had encircled some which were composed entirely, or almost entirely, of old males, and others of young males. They were of the opinion that the porpoises migrated northward in the spring and southward in the fall. They stated, however, that a few remained in the vicinity of Hatteras throughout the summer.

Colonel Wainwright informed me that the fetuses found in the females captured in September were small, and that he had noticed a gradual increase in size as the season advanced. I do not doubt the correctness of this observation, but it appears to be true also that the

foetuses found at any specific date, as well as the young, vary considerably in size. Several of the females captured during my stay at Hatteras contained large foetuses, but they were not all of the same size. Two foetal skulls which I obtained on the same day measure 240 and 163 millimeters in length respectively. We have also noted above that the young individuals in the schools examined varied greatly in size. From these facts it would appear that although the birth of the young may be said in general terms to take place in spring, the breeding season extends over a considerable period. It is a well-known fact that among the terrestrial mammalia the southern representatives of those species which have an extensive range north and south breed earlier in the year than the northern representatives. Analogically it seems probable that the porpoises which habitually resort to the most southerly localities in autumn breed earliest in spring, while those that remain in more northerly parts during the winter breed later.

If this supposition is correct, it accounts perhaps for the disparity in age of the individuals in the different schools. One can readily imagine that during a migration individuals from different localities would meet and journey together, and that the young in quite different stages of development might be found in the same school.

The nursing females, as well as the gravid ones, are recognizable by the increased size of the abdominal region, due to the enlargement of the great milk glands.

The largest porpoise taken at the Hatteras fishery was 12 feet in length and yielded 24 gallons of oil. The average yield in winter is about 8 gallons, but the amount falls to 3 or 4 gallons later in the season.

My attention having been drawn to the question of the correlation between the condition of the teeth, the navel, and the hairs on the lip in young individuals, I made some special observations in the case of the five youngest porpoises captured May 19. The results obtained were as follows:

(1) Female.—Length, 3 feet $7\frac{1}{2}$ inches. Color dark; lips dark. The lower portion of the shafts of the hairs were present, and projected slightly above the skin. No teeth had pierced the gums. The navel was indicated by a simple, distinct fissure about 1 inch long; its lateral margins were not raised above the surrounding integument.

(2) Male.—Length, 4 feet $5\frac{1}{2}$ inches. Color light. The hairs had dropped out, leaving conspicuous depressions in the skin. No teeth visible. Umbilical fissure open, but only about one-fourth of an inch in length.

(3) Female.—Length, 5 feet 8 inches. Color light. Depressions marking the position of the hairs less conspicuous than in the last individual. Umbilical fissure obliterated. The teeth had pierced the gums, and protruded about a quarter of an inch; their crowns were sharp pointed.

(4) Male.—Length, 6 feet 2 inches. Hair-pits shallow, but distinct. Umbilical fissure obliterated. Teeth about one-half inch above the gums.

(5) Male.—Length, 6 feet 4 inches. Hair-pits still discernible and encircled with white. Umbilical fissure obliterated. Teeth about one-half inch above the gums.

It should be remarked that even in the largest individuals in this school the hair-pits were traceable.

In this species, when the mouth is shut, the teeth of the upper jaw fit into shallow pits in the integument of the lower jaw, situated just outside the lower tooth-row.

The color of the skin was, on the whole, remarkably uniform in all the individuals observed. The upper surfaces were of a clear, purplish lead-gray. This color faded out gradually, and was finally merged in the pure white of the under parts. I noticed, however, some minor variations in the disposition of the two colors. My observations were made chiefly upon the individuals taken in the second haul on May 19.

In some of these the white of the belly stopped abruptly opposite the eye, and narrow bands of slate-color, or plumbeous gray, coursed the breast from a point between the pectorals to the junction of their posterior margin with the body. On the sides of the head the dark color generally extends downward to the level of a line drawn between the corner of the mouth and the anterior base of the pectoral fin. If the lips are dark the boundary of the dark color of the head falls below the corner of the mouth. A dark ring around the eye is usually perceptible, and a line runs thence to the junction of the beak with the protuberance of the forehead. There is also a faint band running from this latter point along the median line to the blow-hole. On the sides the light color of the under parts rises somewhat higher immediately behind the pectoral fins than in the middle. Posteriorly its upper boundary slants downward to the genitals, which are included in the light-colored area. The lips have a yellowish cast.

The young, as already indicated on page 200, vary considerably as regards the depth of the gray color of the upper surfaces.

The porpoises which were hauled up on the beach made violent upward and downward strokes with the tail when disturbed. I could not perceive, however, that there was any independent sculling motion of the caudal fins themselves.

The fishermen informed me that the young porpoises remained near their mothers when the latter were entangled in the nets, as sometimes happens. I witnessed this in the case of one female, which became entangled quite near the beach. I did not, however, find the young porpoise among those captured. It probably escaped by diving under the net, as the adult porpoises often do.

Colonel Wainwright informed me that the mothers assisted their

young in their efforts to breathe by bearing them up to the surface of the water on their flippers, or otherwise. I did not observe this action myself.

The spiracle, or blow-hole, appears to be a sensitive part of the head. When I touched it with my hand the porpoises invariably showed signs of discomfort by lashing the tail violently.

The eyelids appeared to be as mobile as in the ordinary terrestrial mammalia. They were closed when the hand was brought near the



a



b

FIG. 1.—a, Pupil contracted; b, Pupil dilated.

eye. The iris of the eye is brown. The contraction and expansion of the pupil take place in a peculiar and remarkable manner, as shown in figure 1. When contracted the pupil takes the form of a semicircular line with the convexity downward. When expanded the aperture is wide, and has nearly the form of a half-ellipse. To produce these different effects, the lateral and lower parts of the iris remain nearly or quite stationary, while the superior portion is either drawn upward or allowed to drop downward.

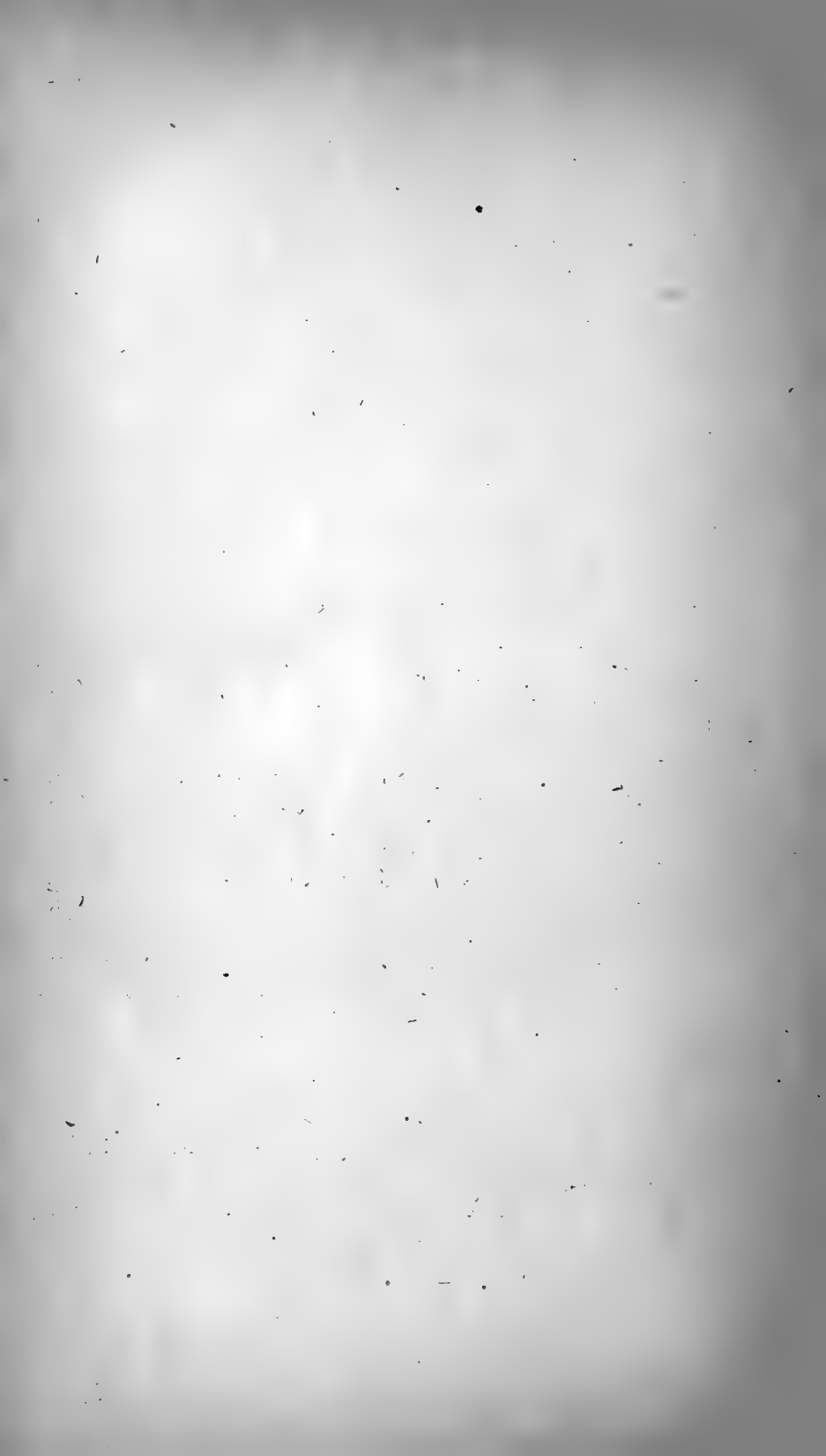
These porpoises appear to be subject to disease and to encounter various accidents. Colonel Wainwright informed me that one porpoise taken at the fishery had a piece of cable lying across the mouth near the last tooth. There were evidences that it had originally been of considerable length and had trailed along the sides. In certain individuals some shot was found, and in one a portion of the sword of a sword-fish.

Among the porpoises which I examined, one had a deformed dorsal fin, and in another the end of the pectoral fin was twisted out of its natural plane and much thickened. All the porpoises were marked with fresh scratches and the scars of earlier ones. The males bore more of these marks than the females. One female had a diseased jaw; the skin of this part was tumid and bark-like, and of a white color. Many individuals have, besides scratches, certain smooth, circular, white blotches on the skin, which are apparently due to disease of parasitic origin.

Certain of the porpoises which appear in the spring are called "tassel-fins" by the fishermen. I discovered that these were individuals which bore on their fins a greater or less number of parasitic cirriped crustaceans of the genus *Xenobalanus*. The specimens which I collected are not now at hand, and I can not therefore state positively to what species they belonged. They appeared, however, to be *Xenobalanus globicipitis* of Steenstrup. Three or four of the porpoises taken May 19 were accompanied by these parasites. The fishermen informed me that the parasites were first seen in May or at the end of April, but did not know whether they could be found on the porpoises in summer. None are seen, however, when the fishing is resumed in the autumn.

The number of porpoises taken at Hatteras during the season of 1884-'85 was as follows :

November 15 to 31	246
December	89
January	36
February	111
March	219
April	264
May 1 to 15	303
Total.....	<hr/> 1,268



SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COM-
MISSIONS STEAMER ALBATROSS.

[Published by permission of Hon. Marshall McDonald, Commissioner of Fisheries.]

No. XVII.—DESCRIPTIONS OF NEW WEST AMERICAN LAND, FRESH-
WATER, AND MARINE SHELLS, WITH NOTES AND COMMENTS.

BY

ROBERT E. C. STEARNS,
Adjunct Curator of the Department of Mollusks.

(With Plates xv-xvii.)

The forms described below are a part of the collections in the Department of Mollusks, U. S. National Museum, and have been received from various sources as indicated in the description in each instance. Those from Dr. C. Hart Merriam were either collected by him personally or by collectors employed by him in connection with the biological explorations of the Department of Agriculture, under his supervision. Others were received from the Hon. Marshall McDonald, U. S. Commissioner of Fisheries. The latter are a part of the *Albatross* collections during the year 1887-'88 made by Prof. Leslie A. Lee and his assistants; and again the collection made in 1855 by the English naturalist, Thomas Bridges, has its representative, contributed by him to the Stearns collection many years ago.

The Museum is further indebted, directly or indirectly, to other collectors whose names appear in connection with the descriptions. For the purposes of comparison figures of certain species contained in the National collections that have not heretofore been figured, or properly figured, are given, with comments thereon, such as naturally arise in the course of a critical examination of related material or forms, the publication of which may be of some service to students of conchology throughout the country who reside at a distance from libraries and museums.

Order PULMONATA.

Suborder GEOPHILA.

Family HELICIDÆ.

Genus **HELIX** Linné.

Group Arionta Leach.

Helix (Arionta) *coloradoensis* sp. nov.

Plate xv, Figs. 6, 7, 8.

Shell orbicular, moderately depressed, whorls slightly elevated, apex obtuse, number of whorls four to four-and-a-half, rounded. Umbilicus narrow, showing the penultimate whorl, though partially covered by the reflection of the lip at the point of junction with the base of the shell. Aperture obliquely ovate, nearly circular, and almost as broad as high. Lip slightly thickened and reflected, or simple, varying in this respect; more reflected and aperture more effuse at the columella. Parietal wall in the heavier examples calloused, the callous connecting with the inner edges of the outer lip above and below. Shell rather fragile, thin, translucent; surface smooth and shiny, and sculptured with fine incremental lines. Color pale horn to white, and otherwise marked by a single narrow revolving reddish-brown band just above the periphery, which in some specimens is obscure or absent. In some individuals certain faint scars upon the upper whorls imply an occasionally hirsute character.

	Millimeters.
Maximum diameter of largest.....	15.25
Minimum diameter of largest.....	13.25
Altitude of largest.....	10.25
Maximum diameter of smallest adult.....	13.75
Minimum diameter of smallest adult.....	12.00
Altitude of smallest adult	8.75

HABITAT.—Grand Cañon of the Colorado, opposite the Kaibab plateau, at an elevation of 3,500 feet. (Mus. No. 104100.)

The above, while exhibiting a facies or aspect of its own, is nevertheless suggestive of *H. Remondi* Gabb, Mazatlan, in the Mexican State of Sinaloa, and also from the high mesas or table-lands in the neighborhood of Mulege, Lower California. *H. Carpenteri* Newcomb, which is a synonym of *H. Remondi*, is credited by the author to "Tulare Valley," and has been found in other localities in California. A glance at the map will show how widely separated geographically, *H. Coloradoensis* is from its nearest allies, and this discovery of Dr. Merriam's extends the distribution of the west coast type of *Helices* farther to the eastward than heretofore, and adds an area of great extent to that previously known,

Helix (Arionta) magdalenensis sp. nov.

Plate xv, Figs. 11, 12, 13.

Shell orbicular, much depressed, apex whorls but very slightly elevated, suture well defined. Whorls three and a half to four, flattened above, slightly obtusely angulated on the periphery, and rounded below. Umbilicus open, showing the whorls; upper line of the mouth more or less slanted downward where it joins the body whorl, varying in this character in different specimens. Aperture broader than high, ovate, somewhat oblique, slightly effuse, and thickened and reflected a little at the edge, more so in the umbilical region, where it partially overhangs the umbilicus. In some examples a thin deposit of callus on the parietal wall suggests a continuous peristome. Surface sculptured by the ordinary lines of growth, which vary in prominence in different individuals. Color, dingy whitish, the specimens, *nine* in number, being dead, with an obscure, narrow, reddish-brown band just above the periphery.

Dimensions.

	Millimeters.
Maximum diameter of largest.....	13
Minimum diameter of largest.....	10
Altitude of largest.....	6.50
Maximum diameter of smallest.....	10.50
Minimum diameter of smallest.....	9
Altitude of smallest.....	5.50

HABITAT.—Magdalena, State of Sonora, Mexico, on the line of the Sonora, New Mexico and Arizona Railroad, which terminates on the Gulf of California at Guaymas. It was detected by Mr. V. Bailey among rocks on the top of a mountain at an elevation of 1,000 feet above the town. (U. S. National Museum, No. 104094.)

This species in its principal features, indicates a relationship with its geographical congener, *H. Rowelli*, Newcomb, which has been found in the Salt River Mountains, 7 miles north of Phoenix, Arizona (Pilsbry). *H. Lohri* Gabb, which is regarded as a synonym of *Rowelli*, collected by its author on the table-lands of Lower California near Mulege, and it has also been credited to Chihuahua, Mexico, and farther eastward to "Texas," upon what authority I am not aware. The relationship of *H. magdalenensis* to *Rowelli* is like that of the Californian snails *H. exata* to *H. arrosa*, of the small forms of *H. fidelis* to *H. mormonum*, or of *H. Stearnsiana* to *H. Kellettii*, etc. Its dimensions are in every way less than those of *Rowelli*+*Lohri*.

The helicoid forms described herein belong to the *Arionta* group, and may be regarded as the southern geographical aspect or an extreme or extra-limital expression thereof. I agree in the main if not altogether with Mr. Pilsbry in his remarks as contained in the paragraph under the head *Lysinoë* in the Proceedings Academy Natural Sciences of Philadelphia, 1889, page 193,* criticising the generic terms, etc., heretofore

* Nomenclature and check-list of N. A. land shells.

applied to the helicoids of the Pacific slope, but I do not perceive the propriety of substituting the generic name *Iysinoë*, H. & A. Ad., 1855, any more than *Aglaia* Albers 1860, for *Arionta* Leach 1820. As for *Helminthoglypta*, *Micrarionta*, *Euparypha*, etc., as applied to the West coast snails, there is nothing in them more or less than a beggarly threshing of beaten straw, not a grain of wheat, or in other words propriety or advantage in their use, neither should *Ampelita*, which is illustrated by the African *H. sepulchralis*, be applied to any of the West American species, as it has been to *Rowelli*, on insufficient and superficial grounds.

Family PUPIDÆ

Genus **HOLOSPIRA**, Von Martens.

Holospira semisculpta sp. nov.

Plate xv, Figs. 1, 4.

Shell dextral, elongately cylindrical, pupiform, largest in the middle, tapering above and below, with fourteen to fifteen whorls; whorls somewhat convex; sutures distinct, though but slightly impressed. The upper two or two and a half whorls which form the apex are smooth, slightly tortuous, papillose. The succeeding four to five whorls are finely obliquely plicated; the middle whorls, four to five in number, are nearly or quite smooth, the sculpture when apparent being inconspicuous. The lower three or three and a half whorls are marked by sharp, thin, and rather obliquely curved liræ, which increase in number or closeness as the mouth is approached. The termination of the basal whorl projects considerably, is sharply angulated above on the projecting portion, which is also obtusely angulated on the under side. Aperture continuous, moderately effuse roundly ovate, and flatly rimmed. Umbilicus a simple chink. Shell of a delicate pinkish white, with a tint of faint purple on some of the upper whorls. Dimensions: Longitude 22 to 23½^{mm}, greatest diameter 5½ to 6^{mm}, number of specimens three (Mus. No. 102310). This well characterized and very pretty species was obtained by Mr. T. W. Stanton, who detected it July 27, 1889, in a cañon above San Carlos, Chihuahua, Mexico, attached in a dormant condition to limestone cliffs. [Since the above was written I have come across a specimen of *H. Coahuilensis* W. G. B., quite unsatisfactorily described by said author; the example is somewhat imperfect, but suggests a geographical if not a more intimate relationship with *H. semisculpta* herein described; the latter may prove to be a variety of Mr. Binney's shell.]

Holospira arizonensis sp. nov.

Plate xv, Figs. 2, 3.

Shell dextral, elongately cylindrical, pupiform, dingy white to pale horn color, translucent. Number of whorls twelve to thirteen. Slightly convex, the sutures distinctly defined. The upper or six or seven

whorls rather abruptly tapering towards the obtuse apex, which has a slightly twisted and rather a papillose aspect. The last whorl is curved under and constricted back of the mouth, forming an umbilical notch. The apex and following whorl are smooth; the three or four succeeding whorls sharply and somewhat obliquely plicated longitudinally, the median and following whorls becoming somewhat obscurely sculptured other than by distinct growth lines. The basal whorl is strongly sculptured below, and back of the mouth, and obtusely angulated underneath. Aperture ovate, slightly angulated anteriorly, somewhat effuse, rimmed and projecting. The dimensions of two examples are as follows:

	Millimeters.
Longitude	12½
Longitude	13
Greatest diameter.....	4
Greatest diameter.....	4

HABITAT—Dos Cabezas, Arizona, where the above two specimens and numerous fragments were found in a cave in November, 1889, by V. Bailey, and contributed to the U. S. National Museum (No. 104392) by Dr. C. Hart Merriam.

Among the species of this group that are geographically related is *H. Remondi* Gabb, described from Arivechi, Province of Sonora, Mexico, a form sharply sculptured throughout, and in minor features also different; *H. Pfeifferi* Menke, collected by Remond at Hermosillo, in the same province, with the previously named species; and *H. (Caelocentrum) irregulare* of Gabb from the high table-lands back of Mulege, in the peninsula of Lower California. All of these are separable at a glance from *arizonensis*.

M. M. Fischer and Crosse, in the "Mission Scientifique au Mexique et dans l'Amerique Central,"* point out the geographical as well as conchological and malacologic relations and characteristics of the group *Holospira*, and furnish a résumé of the species thus far† made known. Their distribution geographically considered is decidedly Mexican and semitropical, and the relations of the shells when the shell characters are considered, as well as certain of the anatomical details, indicate a closer affinity with the *Pupidae* than with the *Cylindrellae*. That there should be what we may be permitted to call outlying posts, and areas exterior to the territory of Mexico, where this general form is represented, may reasonably be expected, for the distribution of life is governed by physical conditions, not by political lines. Quoting from the authorities above cited, we find the number of species in this group up to the date of the foregoing publication to be *thirteen*, supposing the species described to be valid and not synonymous. The names and distribution of these is as follows:

(1) *H. Pfeifferi* Menke, Tehuacan, in the province of Puebla, and variety (β , C. and F.) Hermosillo, in the province of Sonora.

* Septieme partie.

† 1873.

(2) *H. Remondi* Gabb, near Arivechi, valley of Sahuaripa, in the province of Sonora; also a *variety* (β , C. and F.) of same.

(3) *H. teres* Menke, province of Puebla; special habitat not stated; of this there is also a *variety* (β , C. and F.).

(4) *H. goniostoma* Pfr., Mexico; special habitat not given.

(5) *H. Pilocerei* Pfr. The typical form was found in the neighborhood of Cuautla de las Amilpas, province of Puebla, and a *variety* (β , C. and F.); no other locality given than "Mexico."

(6) *H. Tryoni* Pfr., Matamoras de Izucar, State of Puebla, and a *variety* of same (β , C. and F.).

(7) *H. Gealei* H. Adams, Putla, in the State of Oajaca.

(8) *H. Coahuilensis* W. G. Binney, Cienga Grande, State of Coahuila

(9) *H. cretacea* Pfr., "Mexico."

(10) *H. imbricata* Martens, habitat as given "? Mexico," is in all probability correct; "l'ensemble de ses caractères" are, according to Crosse and Fischer, sufficient to indicate its geographical relations.

(11) *H. microstoma* Pfr., ? Mexico. The remarks as to habitat in connection with the previous species may be applied to this with equal propriety.

(12) *H. Goldfussi* Menke, "Texas, on the Blanco," W. G. Binney.

(13) *H. Roemeri* Pfr., "New Braunfels and Howard Springs, Texas, W. G. Binney.

Of the varieties given by Crosse and Fischer, distinguished as " β " of the species *Pfeifferi*, *Remondi*, *teres*, *Pilocerei*, and *Tryoni*, the number of the whorls, size, and sculptural development are, in the main, the basis of varietal distinction. To these may be added another characteristic more or less mutable, the extent of the projection of the basal whorl at its termination from the body of the shell. This varies considerably as a comparison of many individuals will show. The other characters are, we may assume, equally unstable or nearly so, and a large or extensive geographical series would without doubt connect the admitted species and so-called varieties by so gradual a blending of one into the other as to efface the present lines of demarkation. The authors above quoted suggest that *H. Tryoni* may prove to be a variety of *H. Pilocerei*; the latter is largely represented in the national collection, as well as *Tryoni*; a comparison of these hardly sustains the suggestion. Dr. Palmer found somewhere in his rambles in Arizona, Mexico, or New Mexico, a somewhat dwarfed and rather solid form of *Holospira*, that with the exception of size and solidity may be regarded as *H. Pilocerei* (Mus. No. 29303), and it is so named in the collection.

A comparison of individuals shows that the shape of the mouth, the strength of the sculpture, the projection of the basal whorl at its termination, and size, are all variable factors more or less coincident with proximity or remoteness of habitat, or in other words with geographical relations.

To the above enumeration and list must be added :

(14) *H. Elizabethæ* Pilsbry, detected in the "Village of Amula, between Tixtla and Chilopa, State of Guerrero, Southwestern Mexico," a form which in its general features much resembles *H. Gealei*, and may prove to be a geographical variety thereof.

(15) *H. semisculpta* Stearns, near San Carlos, Chihuahua, Mexico.

(16) *H. arizonensis* Stearns, Dos Cabezas, Arizona.

Order CTENOBRANCHIATA.

Suborder STREPTODONTA.

Superfamily TÆNIOGLOSSA.

Family STREPOMATIDÆ Haldeman.

Genus **GONIOBASIS** Lea.

Melania (? **Goniobasis**) *acutifilosa* sp. nov.

Plate xv, Fig. 9.

Shell slender, elongated; whorls rounded, convex; sutures much impressed. Spire eroded above the fourth whorl. Surface sculptured with strong thread-like revolving keels alternating with broad channels; of these keels there are usually six on the body whorl, sometimes more, and generally three only on the preceding whorls, of which the upper two are rather the most prominent and are usually interrupted and regularly broken up, producing an evenly crenulated chain. Following the wind of the shell and just below the sutures, the whorls broadly slope to the succeeding keel, which gives the shell a turritid outline. Surface of shell a very dark horn color, blackish; aperture small, ovate, inside lighter colored than the surface, the substance of the shell being thin and partially translucent, the keels showing through on the inside of the mouth, when held up to the light. Dimensions of largest: Longitudinal, 16.50^{mm}; latitudinal, 7.50^{mm}.

The foregoing description is based on an examination of some three dozen specimens.

HABITAT.—Eagle Lake, California, where this well characterized and interesting form was detected by Mr. Henry W. Henshaw, in June, 1877. (U. S. National Museum collection, No. 60596.)

The above species has the slender habit of other related West American forms, such as *silicula* Gould (= *Shastaënsis* Lea), and *nigrina*, *rubiginosa*, and *Bairdiana*, of Lea. Its sculpture relations are nearer to *occata* Hinds, but that is a robust and more ventricose shell, closely spirally sculptured over and throughout, and lacking the broad sub-sutural slope and differing in other minor features as well as in the character of the aperture, which in Hinds's species is much the largest and more effuse.

The occurrence of the above in the region where Mr. Henshaw found it is not simply interesting in itself, through adding a new locality as well as a new species to what was previously known, but the altitude of Eagle Lake, 5,115 feet above the sea, being considered, is an important point in the matter of the hypsometrical distribution of the group to which the form herein described is allied, and is, so far as I can learn, the highest elevation at which any American species has as yet been detected. The character of the habitat is in another aspect peculiar. The basin of the lake, according to Mr. Henshaw, is composed of a dark-colored lava or scoriaceous matter, and the color of the shell, it would seem, is quite in harmony with this feature of its environment.

As to the generic and malacological relations of those West American forms which Mr. Tryon has included in his monograph of the *Strepomatida*, but little, if anything, is known. Whether their proper place is with the true Melanians or with the East North American *Goniobasis* remains to be shown. It may be found that they constitute, and upon reasonably satisfactory characters, a separate though collateral group. The species above described is therefore placed here provisionally.

Family CAPULIDÆ.

Genus CAPULUS.

Cyclothyca, Subgenus nov.

Shell small, spiral, few whorled; spire short, and body whorl large and transversely elongated or produced. Aperture oblong, ovate, more or less oblique, very large, continuous and effuse. Surface spirally ribbed and marked with longitudinal growth lines. Example *C. corrugata* as follows:

Cyclothyca corrugata sp. nov.

Plate xv, Figs. 5, 10.

Shell subspiral, transversely much elongated or produced; number of whorls two to two and a half, rapidly enlarging. Apex rounded, smooth or nearly so, subvitreous and shiny. Aperture ovate, effuse and continuous, obliquely expanded and much prolonged. Surface of principal whorl ornamented with ten to fifteen revolving ribs, of which the upper or principal ones, seven or eight in number, are the more prominent; otherwise sculptured by more or less conspicuous subsidiary longitudinal growth lines. Sometimes the main ribs, which are broadly channeled between, show slight imbrications, and in one of the specimens the longitudinal growth lines, though secondary to the revolving ribs in prominence, are conspicuously developed and cancellate the sculpture. The apex also varies in prominence; in the example figured it is quite elevated, in another it is nearly appressed to the line of the body whorl. The outer lip is ribbed internally corresponding to

the exterior sculpture, and the aperture is smooth and glossy. The color in one example is yellowish white, in the other the groundwork is of said tint but apparently partially mottled with gray. Dimensions: Altitude 3; latitude 4.25^{mm}. Altitude of mouth, 1.75; latitude 2.50^{mm}.

HABITAT.—West coast of Nicaragua. Two examples, in the collection of the U. S. Nat. Museum (No. 101944).

This peculiar and interesting form has in a very general way the aspect of a tiny *Stomatia phymotis* and is probably parasitic in its habits like *Thyca*, or a domiciliare on some form like *Echinus*. The Adams's subgenus *Thyca* is based on a shell that is "crystalline, acutely conical, slightly curved, longitudinally grooved, parasitic on star-fishes." They include two species, *astericola*, H. & A. Ad., and *crystallinus* Gould; which latter is a small *Helcion*-shaped form, with the apex marginal and somewhat recurved, as in many of the *Hipponycidae*, which it, *crystallinus*, judging by the figure in Gould's Atlas of the Shells of the Exploring Expedition, resembles much more than most examples of *Pileopsis* (= *Capulus*) to which the author referred it. It can hardly be included in the Adams's narrowly restricted subgeneric description. I have thought it better to make a new subgenus than to expand that of *Thyca*, as it is not improbable that other forms will sooner or later be brought to the knowledge of conchologists, that would be naturally grouped with the species described above; perhaps "*Pileopsis*, Fig. 2381, ? *P. Delessertii*" Chenu (*vide* Manuel de Conchyliologie, vol. i, p. 329), should be included in my subgenus, as judging by the figure it is a true spiral shell. I have not been able to find any description of Chenu's shell.

Suborder ORTHODONTA.

Superfamily RHACHIGLOSSA.

Family MITRIDÆ.

Genus **MITRA** Lamarek.

Subgenus **COSTELLARIA** Swainson.

Mitra (? *Costellaria*) *nodocancellata*, sp. nov.

Plate xv, Fig. 14.

Shell small, dark brownish or dingy purple outside, dark blackish purple, glazed in the mouth; slender, rather obtusely elongated, cancellately sculptured throughout, except on the lower part of the basal whorl near the aperture. Number of whorls five, slightly convex. The three following the nuclear show three, the penultimate four and a partial fifth, and the basal whorl nineteen to twenty prominent revolving liræ; these are traversed by numerous equally prominent longitudinal ribs, thus cancellating the surface quite equally, and forming at the

several points of crossing a bead-like nodule. The sutures are distinctly defined, and interrupt the longitudinal sculpture. The aperture, somewhat less than half the length of the shell is narrow, slightly sinused and calloused above, where the outer lip joins the body whorl, suggestive of *Mangilia*, which the shell as a whole much resembles. The outer lip is thickened and crenulated within; the columella is marked by four obtuse, curved plaits, the posterior being the largest. The dimensions of the single example in the U. S. National Museum collection (No. 55490), which is in good condition, are as follows:

Longitude of shell 10^{mm} ; of aperture 4.25^{mm} ; maximum diameter 3.25^{mm} .

HABITAT.—Gulf of California, where it was collected by Mr. W. J. Fisher.

This well characterized little shell has much the same plan of sculpture as *Mitra styria* Dall, of the Antillean region (73 to 333 fms.), the nodular sculpture at the points of intersection being more conspicuously and uniformly developed in the form herein described. In other respects, save generic affinity, there are no features in common in the two species.

Order TELEODESMACEA.

Suborder CARDITACEA.

Family CARDITIDÆ.

Genus **VENERICARDIA** Lamarck.

Venericardia barbarendsis sp. nov.

Plate XVI, Figs. 3, 4.

Shell rounded, inequilateral, variable in outline, more or less oblique, moderately convex. Beaks small, slightly elevated and turned forward. Surface ornamented with nineteen to twenty radiating ribs usually somewhat granulose, and generally obscure on the extreme anterior and posterior margins of the valves. Epidermis a dingy yellowish brown, thicker towards the ventral margin and sides of the valves; thin and commonly eroded at or towards the umbos. Lunule small, slightly sunken, faintly defined. Hinge line small, not thick; hinge composed of, in the left valve, a single strong cardinal sloping posteriorly and a smaller tooth often obscure, slanting anteriorly; a third tooth-like process is generally present, situated under and apparently a projection of the edge of the lunule. This latter varies much in prominence in different specimens, and is often but barely perceptible. The hinge in the right valve is characterized by a single strong cardinal tooth with a slanting, somewhat sinuous groove above, and a slight notch and tooth-like point below the upper part of the lunule; this latter character

is frequently inconspicuous and feeble. The valves are rather thin and somewhat translucent, bluish white on the inside and showing the ribs when held up to the light.

Dimensions: From umbones or beaks to opposite edge 15^{mm}, from anterior to posterior edges 15^{mm}, varying the fraction of a millimeter in either or both of these dimensions in different individuals.

HABITAT.—Station 2840, off Station Barbara Islands, California, in green mud at 276 fathoms depth; U. S. Fish Commission steamer *Albatross*, May 8, 1888. Very abundant; several hundred specimens were obtained (U. S. National Museum, No. 104045).

A comparison of this shell with Gould's *ventricosa* (Pl. XVI, Figs. 5, 6), shows not only a great difference in the elevation of the beaks and form (outline) of the valves but in the characters of the hinge, as well as the thickness of the hinge plate. In *ventricosa* as well as in *borealis* and *Miodon prolongatus* the long solid posterior cardinal is strikingly conspicuous when compared with the same in *barbarensis*, which is much shorter, slighter, and without curve; the anterior cardinal is solid and thick with a somewhat diverging curve (*i. e.*, *curving away*) from the posterior cardinal. In *prolongatus* and *borealis* the anterior cardinal is triangular and solid and *perpendicular* to the point of the umbos, or nearly so, with a hint in *borealis* of cleavage in said tooth, while in *barbarensis* this tooth is acutely elongated and sinuously ovate and diverging anteriorly. Both *ventricosa* and *borealis* exhibit a small rounded tuberculoid process anterior to the anterior cardinal, rather inconspicuous, and quite likely absent in some cases. This tubercle is *submarginal* in these two species, and altogether absent in Carpenter's shell *prolongatus*, if we may judge by the example figured (Pl. XVI, Figs. 7, 9); while in *barbarensis* this character is seen to be, as elsewhere remarked, a simple *projection of the edge of the shell* at the base or lower margin of the lunule, varying in prominence, as before remarked, in different individuals.

Venericardia borealis Conrad.

Plate XVI, Fig. 8.

This form was described by Conrad on page 39 of his *American Conchology*, of which only a few parts were published, and a figure given, which shows the exterior of the right valve and an upper inside portion of the left, with the hinge, the latter not as definitely figured as is desirable. The description is quite brief and unsatisfactory when compared with Dr. Gould's in the *Invertebrata of Massachusetts*, wherein *Arcturus rudis* Humphrey MS, and *Cardita vestita* Deshayes, are included as synonyms. It is common in many places on the Atlantic sea-board, off shore, at various depths, from the Arctic sea to Hatteras, at from 5 to 100 fathoms. Say's *granulata*, and Morse's *nov-angliæ*, which Mr. Dall regards as varietal forms,* imply differences or

* *Vide* Bulletin 37, U. S. National Museum, p. 46.

aspects in sculpture and outline, analogous to the various facies exhibited by the same species on the Pacific side. Professor Verrill makes Conrad's name a synonym, and gives Say's *granulata* priority, and regards the form, which Morse named *novangliæ*, "as a mere variation* of this common and variable species," etc. Gould says "*vestita* is an elongated middle-aged variety;" and further, in comparison, *C. tridentata* Say, differs from *borealis* in the hinge, the latter having "two teeth in the right valve, while that shell (*tridentata*) has but one."

The form familiarly known by Conrad's name is common in the northern part of the two great oceans that bound the continent, and, with its varieties, may be regarded as circumpolar.

Venericardia ventricosa Gld.

Plate XVI, Figs. 5, 6.

The figures given herewith were made from Dr. Gould's type, now in the National Museum (No. 3373), which is also figured and described (July, 1850) in the "Exploring Expedition" volumes. It was detected in Puget Sound. Dr. Carpenter, in discussing the Expedition shells in his Supplementary Report to the British association (Smithsonian miscellaneous collections No. 252, reprint, *vide* page 17, as indexed), says: "[Appears to be a local variety of the ancient Miocene species, *Venericardia borealis* + *C. occidentalis* Conr. + *C. subtenta* Conr. (fossil) probably.]"

Conrad described his *C. occidentalis* from a fossil example collected at Santa Barbara, by Dr. Newberry, in the Proceedings of the Academy of Natural Sciences, of Philadelphia, December, 1856, without a figure. The latter is given only an exterior view, however, in Volume VI of the Pacific railroad reports, but minus the description. The figure in the last-named volume, so far as it goes, may be applied to Gould's species, but not without doubt, as a knowledge of the hinge characters is absolutely necessary in the forms of this group to make determination possible. Conrad's description in the Philadelphia Proceedings is so meager and general as to be of no value whatever, and is really without any title or claim to consideration for this reason. In his description he says that it is allied to "*C*—, of the San Pedro recent formation," etc., which is about as valueless a reference for the purposes of comparison as can well be imagined.

Upon looking up the *subtenta* of Conrad, we find it among the Astoria (Oregon) fossils described in Volume X of the "Exploring Expedition," App. I, page 726, 1849. Carpenter refers to it thus on page 679 of his supplementary report (p. 165 of reprint): "*Cardita subtenta*, Conr., = *Venericardia borealis* Conr.," but in this as with *occidentalis*, the description furnishes no light of a definite character. The dimensions as

*Verrill's Second Catalogue of Mollusca, etc., Trans. Conn. Acad., 1884, p. 258.

given by Conrad are, "length and height three-fifths of an inch, thickness two-fifths of an inch." The figures (Pl. 18, Figs. 12, 12a, atlas) show only the exterior of the specimen, and are about the same in size and other respects as that of *C. occidentalis*, before mentioned, so that while Carpenter's inclusion of these imperfectly described fossils as synonyms of *borealis* may be right, it will be seen from what I have stated as the result of my search and examination of Conrad's description, such an association of these specific names is altogether presumptive and simple guess-work.* It will be seen also, upon recurring to my first quotation from Dr. Carpenter, that he regarded *ventricosa* as a local variety of *borealis*, but a comparison of the hinge characters as shown in the figures is sufficient to settle the question. The cardinal tooth in *ventricosa* (left valve) as figured, it will be seen, is short and curved towards the lunule, while in *borealis* it is triangular, obtusely wedge-shaped and grooved, hinting at cleavage or forking, as previously indicated. Examples varying in size from 37^{mm} from beaks to ventral margin, and 37.50^{mm} in the opposite direction, to those measuring 11.50^{mm} from beaks to ventral margin, and 11.25^{mm} in the other direction, exhibit this character, the larger individual (Museum No. 74194) being from the neighborhood of the Aleutian Islands, Alaska, and the smaller (Museum No. 73455) from 30 fathoms near Catalina Island, in the Santa Barbara channel. The identity of the latter is further confirmed by Dr. Carpenter's initials on the label.

Genus **MIODON** Cpr.

Miodon *prolongatus* Cpr.

Plate XVI, Figs. 7, 9.

This subgenus and species were described by Philip Carpenter in the *Annals and Magazine of Natural History* (third series), Vol. XIV, December, 1864, p. 424. The author made this subgeneric term to cover and include, as he says, certain "species intermediate in character between *Astarte*, *Venericardia* and *Lucina*. It first appears in the great Oolite, where it is represented by *Astarte* (*Miodon*) *orbicularis* J. Sby., *Min. Conch.*, Pl. 444, Figs. 2, 3. This must not be confounded with a second and true *Astarte orbicularis* by the same author, Pl. 520, Fig. 2. It appears in Mr. Searles Wood's Crag-series as *Astarte corbis*."

The form described by Carpenter as above is the only recent species known.

Several specimens are contained in the National collection, including No. 15742, from Neeah Bay, and Mr. Dall obtained several examples in the Alaskan region at Middleton island.

* Gabb (*Paleont. Cal.* II, p. 100) unites under the name of *C. ventricosa* Gld. the *subtenta* and *occidentalis* of Conrad and his own *C. monilicosta*. The very imperfect types of the fossils in the U. S. Nat. Museum indicate that this may be a correct conclusion, though all that we can positively assert in regard to the fossils is that they are certainly not *C. borealis*.

It is a small shell, the dimensions of the type, as stated by Carpenter, being "long. .23, lat. .24," and the diameter or thickness .16 of an inch. The shell is figured above for the first time.

The varied and striking forms of the *Carditidae* are conspicuously represented on the western coasts of North and South America from the subarctic waters of the Alaskan region as far to the south as Valparaiso in Chili.

While some are globose and heart-shaped like the typical cockles (*Cardium*), others are exceedingly transversely elongated, and these extremes are connected by intermediate forms.

Of the cockle-shaped group, of which the commonly figured *C. sulcata* Lamarck may be regarded as an average illustration, we find the following in the monographs credited to the Pacific shores of the two continents: *C. Cuvieri*, the monarch of the group, with the varied and peculiar *C. flammea* Mich., of which the *C. varia* and *C. tumida* of Broderip are synonyms; *C. crassa* Gray and *C. laticostata* Sby, these two rather intermediate and between the elevated umbonal and the more elongate forms. While the extreme cockle-shaped forms in the elevation and development of the umbones, as exhibited in large examples of *C. flammea*, approach *Isocardia*, yet the opposite extreme of transverse elongation is gradually approached, and these two remote aspects of shell characters connected, as may be seen when the general group is reviewed as a whole.

Following the more rotund, the suborbicular species of the *Venericardia* fall into place, represented by Conrad's *borealis*, Gould's *ventricosa*, and my *barbarensis*, as above described, and certain small forms, dwarfs or adolescents, perhaps extra-limital aspects of the several facies of *borealis* figured and named by Reeve (*Conch. Icon.*, Pl. IX) as *C. compressa*, *flabellum*, and *semen*; the first and second from Valparaiso, the third from the Bolivian coast, all small, insufficiently described, and imperfectly figured. In addition to these is *C. tegulata*, a small shell also in Reeve in the plate cited; it is coarsely ribbed, and in outline resembles *flabellum*. Carpenter's *prolongata* comes in here, a little oblique shell with high umbones, and there are varieties of *borealis*, small and semi-globose, with granulose ribs. The granulation of the ribs and elevation of umbones are varietal or local features, perhaps both. *C. borealis* Conrad is figured here (Plate XVI, Fig. 8) for comparison with the other species above noted.

The transverse shells of the group *Carditamera* (Conrad, 1838=*Lazania* Gray, 1853) includes the following:

C. pectunculus Brug., 1790; *C. affinis* Sby., 1832; and *C. californica* Desh., 1852. The first has been credited to Madagascar,* no doubt erroneously, and so far as I can learn said habitat has never been confirmed. A large example of *C. californica* which I have in my hand at the moment of writing this, fits exactly to the figure in every way

* Reeve's *Conch. Icon.* species 4, and Fig. 4, Pl. 1.

and furthermore agrees in every respect with the description. *C. pectunculus* is included in Lister's *Conch. Hist.*, Oxoniæ, 1770, Pl. 347, Fig. 185, and is the *Chama pectunculus* of Dillwyn, etc.

C. californica is nothing more than a varietal form of *affinis*, and the alleged distinctions fade away or blend gradually when a large series are placed side by side for comparison.

A form nearly related to the foregoing and closely resembling individuals of the *affinis-californica* aspect is the *C. radiata* Brod. (1832), in Reeve's Monograph, Pl. 1, Fig. 5, collected at Panama and elsewhere along the coast of the same general region. Two specimens in the National Museum (No. 15906) were determined by Cuming as this species; one of them, upon careful examination proves to be the common *affinis* of Panama, the other agrees closely with Reeves's figure, above noted, in form, color, etc., as well as with the description.

I should have included it, with perhaps a passing comment, with the other three, had it not had the initials of Mr. Cuming on the label, which led me to scrutinize it closely. There is a difference in the shape and direction of the central cardinal tooth in the left valve, which, if varietal, is certainly rather an unusual aspect of variation, and may be regarded more properly as abnormal, if the many other characters which connect with the forms previously named should be allowed to outweigh this single differential feature.

Carpenter's little "*Lazaria subquadrata*," of the upper Californian province, comes in here. It is an interesting form, combining the coarse exterior ribbing and aspect of the *laticostata* group, with the hinge characters of *Carditamera*.

The peculiarly interesting form upon which Mr. Dall has made the genus *Milneria*, with one species, *minima*, completes the list of West American *Carditas*, which may be summarized as follows:

C. Cuvieri Brod.

C. flammea Mich., + *C. varia* Brod., + *C. tumida* Brod.

C. crassa Gray.

C. laticostata Sby., + *C. tricolor* Sby.

C. (Venericardia) ventricosa Gould, + ? *C. occidentalis* Conr., + ? *C. subtenta* Conr., the last two fossils.

C. (Venericardia) borealis Conr.

C. (Venericardia) barbarensis Stearns.

C. (Miodon) prolongatus Cpr.

C. (Carditamera) pectunculus Brug., + *affinis* Sby., + *californica* Desh.

C. (Carditamera) subquadrata Cpr.

C. (Milneria) minima Dall.

Doubtful and imperfectly described or figured, perhaps in some instances synonyms of the foregoing.

C. monilicosta Gabb.

C. (Venericardia) compressa Rve., ? = *borealis* Conr.

C. (?) Venericardia) flabellum Rve.

C. semen Rve.

C. tegulata Rve.

C. (Carditamera) radiata Brod. ? = *pectunculus* var.

The subgeneric distinctions made in the *Venericardia* group by Conrad are simply frivolous and uncalled for. The intimate relationship of forms like *borealis*, *ventricosa*, *tridentata* and *barbarensis*, are apparent at a glance, and the differences upon which these distinctions are based, as in *Cyclocardia* and *Pleuromeris*, are of no greater than specific value. It is highly probable that this criticism might with propriety be extended to other related genera, which have been admitted and perpetuated in conchological literature.

Suborder LUCINACEA.

Family LUCINIDÆ.

Genus **LUCINA** Brugnière.

Lucina æquizonata sp. nov.

Plate xvii, Figs. 3, 4.

Shell moderately convex, dull white chalky where eroded; epidermis of a dull dingy light yellowish tinge, finely wrinkled in old specimens, and inclined to be deciduous and slightly flaky or ragged; in young shells, translucent, shiny, and nearly colorless. Valves transversely ovate, being broader than high; the posterior side is abruptly squarish, and the dorsal line slants gradually from the umbones; on the anterior side the dorsal outline is moderately concavely curved away from the beaks, and in young and perfect specimens a very slight angulated pinch may be seen extending from the lunule to the anterior edge of the valves. The beaks or umbones are small, inclined towards the lunule; the lunule is quite narrow, attenuately lanceolate and elongated. Surface of valves transversed with fine concentric growth lines, and prominent rather regularly spaced thread-like ridges. Hinge line curved and showing two diverging cardinal teeth in each valve; the anterior one in the left valve, and the posterior one in the right valve, notched or partially cloven. Elongated, tuberculoid lateral teeth in both valves at extreme limit of dorsal or hinge line. Dimensions: From beaks to ventral margin, 37.50^{mm}; from anterior to posterior edges of valves, 46.25^{mm}. Individuals otherwise of same dimensions vary much in rotundity; two examples measure, the one 21.75^{mm}, the other 17.75^{mm} diameter or thickness.

HABITAT.—Off Santa Barbara Islands, California, in green mud in 276 fathoms May 8, 1888, U. S. Fish Commission, Steamer *Albatross*, common (fifty specimens), Museum No. 104044.

In Stimpson's *Lucina filosa* (Museum number 92679, see Plate xvii, figures 5, 6), there are *no lateral teeth*, and the valves are more nearly orbicular in outline. In *L. borealis*, the European form, to which Carpenter assigned the specimens dredged by Dr. Cooper near the islands in the Santa Barbara Channel (30 to 120 fathoms), there is an inconspicuous anterior lateral discernible *in the right valve, but no posterior lateral*.

In *filosa* and *borealis* the cardinal teeth in form, position, and angle are very nearly or quite alike.

In *L. jamaicensis*, of the same group, the laterals are conspicuous and strong; the cardinals inconspicuous, the anterior lateral in the right valve prominent and stumpy, the posterior lateral in the same valve elongated, ridge-like. The surface sculpture in *filosa*, *borealis*, and *jamaicensis* differs each from the other; the texture of the shells in these species also varies, the two latter having a much firmer and compact and porcellaneous aspect than *filosa*, and *filosa* having a firmer texture than the Santa Barbara form, which latter has a surface aspect in the matter of texture much nearer to *L. lamellosa* Smith. The latter is a somewhat tumid and angulated form from the Straits of Magellan, and has a rather rounded tuberculoid lateral on the anterior side of the valves.

The anterior dorsal region, it will be seen by looking at the figures, is markedly different in Stimpson's *filosa* from *aquizonata*.

Suborder VENERACEA.

Family VENERIDÆ.

Genus VENUS Linn.

Subgenus CHIONE Megerle.

Venus (*Chione*) *effeminata* sp. nov.

Plate xvii, Figs. 1, 2.

Shell triangularly transversely ovate, the anterior outline rounded, the posterior more elongated and obtusely angulate. The proportions of the shell are as follows: Three-fifths of the length are posterior to a (perpendicular) line drawn from the umbones to the ventral margin; the height of the shell on said line as compared with the length is as four to five.

The valves are moderately convex, and the surface is prettily and evenly cancellated by forty-five to fifty rounded ribs radiating from the beaks and divided by grooves of nearly the same width as the ribs; both ribs and grooves are crossed by thirty to thirty-five or more sharp, elevated, concentric, thread-like striæ, so fine at the beaks as to be scarcely discernible. Color whitish, purplish in the umbonal region. The beaks are pink, sharp, proximate, and turned towards the lunule, which latter is ovately cuneiform and distinctly defined. The ligamental area is narrow, elongated, somewhat excavated, and slightly keeled. Interior of valves rosy purple and crenulated on the edges from a point about midway up the anterior margin to a similar point on the opposite end, the crenulations peculiarly sharp and squarely cut.

Hinge plate moderately thick; the right valve exhibits two strong and one upper thin elongated subsidiary tooth, just under and parallel

to the edge of the lunule; of the principal cardinals one is acutely triangular or wedge-shaped and slopes posteriorly, the other is elongately triangular, somewhat curved and prolonged anteriorly and below the subsidiary tooth. Between the principal cardinals is a triangular pit into which the central cardinal of the left valve fits; the left valve also exhibits a slender elongated tooth on each side of the principal, cardinal, which fit into corresponding grooves in the right valve. The muscular scars are large for so small a shell, and the pallial impression is broad and shiny and considerably back from the edge of the valves, and the sinus moderately deep and rounded, its upper edge curving to and touching the lower part of the posterior adductor impression.

Dimensions: From beaks to ventral margin, 10^{mm}; from anterior to posterior edges, 13^{mm}.

HABITAT.—Panama Bay, where it was collected by the late Thomas Bridges.

This little shell, now belonging to the U. S. National Museum (No. 102181), was received by the author many years ago with the remains of the Bridges collection of mollusks; it has not been described heretofore for want of access to the literature and material necessary to determine the fact of previous description or the reverse. It is a strongly characterized form, with every aspect of maturity, and quite distinct from any of its nearest allies.

Order ANOMALODESMACEA.

Suborder ANATINACEA.

Family ANATINIDÆ.

Genus **PERIPLOMA** Schumacher.

Periploma discus sp. nov.

Plate XVI, Figs. 1, 2.

Shell thin, fragile, white, translucent, seminacreous; inequilateral, nearly circular, being posteriorly subangulated and flexuously squarish and produced; inequivalve, the left valve being more ventricose than the right; valves somewhat gaping; pallial impression, narrow, shiny, distinct; sinus rather deep and rounded interiorly and curving up to the adductor scar; beaks small, nearly central, fissured; hinge a hollowed spoon-shaped process (projecting inwards from below the beaks), which holds the cartilage; this spoon-shaped cartilage cup or process is strengthened by an elongated callus slanting anteriorly; the exterior surface of the valves is finely wrinkled and linearly scabrous (more easily seen by holding a valve up to the light) and otherwise marked by concentric lines and zones of growth.

Two specimens are contained in the National collection (Museum No. 105391), the largest of which measures from the beaks to the ventral margin or edge 36^{mm}, from the anterior to the posterior edges in the broadest place 41^{mm}, and the thickness or diameter is 14.50^{mm}.

HABITAT.—San Pedro, Long Beach, etc., Los Angeles County, California; Mrs. M. Burton Williamson and others.

This is an unusual form for a member of the *Anatina* group, and quite distinct from any of the West coast representatives of the family heretofore described.

The *Anatina* (*Periploma*) *alta* C. B. Ad. (Panama shells, p. 294), described from a single valve, is a transverse form, the measurements as given by the author being as follows: "Length, 1.98; height, 1.35; breadth 0.7 inch.," or nearly seven-tenths (0.67) of an inch more from the anterior to the posterior margin than from the beaks to the ventral or opposite edge of the shell.

This should not be confounded with *P. alta* Conrad (Proc. Acad. Nat. Sci. Phila., p. 585, 1862, Am. Journ. Conch. II, p. 70, pl. 4, fig. 10, = *P. peralta* Conr., Am. Journ., Conch. iii, p. 188, Sept., 1867), from the Miocene of New Jersey, which is a rounded form not unlike *P. discus* in general appearance.

Periploma excurva Cpr. is also a transversely elongated form, though less inequilateral than the foregoing, and measures, as quoted, "long. 2.06; lat. 2.46; alt. 1.05 poll."

Periploma papyracea Cpr., described by the author from one "perfect valve and a broken pair displaying the hinge *in situ* are all that is known of this beautiful species. It differs from the others in its outline, the greater part of which is suborbicular, with a short broad beak."

The dimensions are given as "long. 0.78; lat. 1.06, alt. 0.42 poll."

P. excurva and *P. papyracea* are both described on page 229 of the Proceedings Zoölogical Society of London, with many other forms "principally in the collection of Hugh Cuming." *P. papyracea* is, it will be seen, somewhat more equilateral than *P. excurva*, yet much less so than *P. discus*.

In Carpenter's British Association Report (1856), on page 287, he erroneously refers to *P. excurva* as "*P. excurvata*." *Periploma argentaria* Conrad is the name usually given to the commonest of the west American species; it was described by the author in 1837.* Dr. Gould regarded the shell described by Conrad as the same to which Sowerby had given the name of *planiuscula* in 1834.† In the same place Sowerby has described still another species, *P. lenticularis*, from the island of Murte, which is in the Bay of Guayaquil, about 3 degrees south latitude. The examples of *P. planiuscula* described by Sowerby were collected at St. Elena, a point on the northerly boundary of the same gulf, and both of these species by Cuming. Carpenter makes no allusion to *lenticularis*

* Jour. Phila. Acad. Nat. Sciences, Vol. VII. Part II, 1837, p. 238., Pl. 18, Fig. 8.

† Proc. Zool. Society London, 1834, p. 87.

in either of his reports to the British Association, probably for the reason that its habitat was exterior to the geographical limits covered by said reports, or south of the range of coast covered by his investigations. His reference to *planiuscula* was no doubt owing to Dr. Gould's opinion of its identity with Conrad's *argentaria*.

If my conclusions, resting upon a careful consideration of the descriptions published, as well as a comparison of the figures when given, and further upon diagrams carefully worked out from the measurements as published where figures are lacking, are correct, it is altogether certain that the number of species as alleged must be greatly reduced. With the dominant West American form and its varied aspects I am perfectly familiar, having seen and handled a large number, as well as collected it, and of the identity of the forms described by Conrad and Sowerby I have no doubt. Though Conrad's *argentaria* is the most familiar name and in general use, and again more appropriate than Sowerby's *planiuscula*, yet, as a matter of fact, the latter's has priority by three years. It is highly probable, hardly a doubt, that Hanley's *obtusa*, C. B. Adams' *alta*, Carpenter's *excurva*, and Sowerby's *lenticularis* all fall to the rear as synonyms. Conrad's *Leana*, included by Carpenter in the Smithsonian checklist of the shells of the west coast of North America, must be eliminated, as it is an East North American form described by the author* from a Rhode Island specimen. A revised list of the West American species will read thus.

1. *Periploma planiuscula* Sby.
 + *P. lenticularis* Sby.
 = *P. argentaria* Conr.
 = *P. alta* C. B. Adams.
 = *P. excurva* + *P. excurvata* Cpr.
2. ? *Periploma papyracea* Cpr.
3. *Periploma discus* Stearns.

Of the above, 1 and 3 occur in what Carpenter has termed the "Oregonian and Californian Province," and 1 and 2 in his "Mexican and Panamic Province." They are however rather southern than northern shells, and I am not aware of their occurrence north of Point Conception.

* Jour Acad. Nat Sciences, Phila., VI. 263, Pl. 11, Fig. 11.

EXPLANATION OF PLATES.

NOTE.—As the figures of the plates are amplified or reduced from the natural size in proportions which are not the same for all the figures, in the explanation to the plates, after the name of the species, the actual height or length of the specimen figured is given in millimeters.

PLATE XV.

- FIGS. 1, 4. *Holospira semisculpta* Stearns; lon. 23.0^{mm}; p. 208.
2, 3. *Holospira arizonensis* Stearns; lon. 13.0^{mm}; p. 208.
5, 10. *Capulus (Cyclothyca) corrugatus* Stearns; alt. 3.0^{mm}; p. 212.
6, 7, 8. *Helix (Arionta) coloradoënsis* Stearns; max. diam. 15.25^{mm}; p. 206.
9. *Melania* (? *Goniobasis*) *acutifilosa* Stearns; alt. 16.5^{mm}; p. 211.
11, 12, 13. *Helix (Arionta) magdalenensis* Stearns; max. diam. 12.5^{mm}; p. 207.
14. *Mitra* (? *Costellaria*) *nodocancellata* Stearns; alt. 10.0^{mm}; p. 213.

PLATE XVI.

- FIGS. 1, 2. *Periploma discus* Stearns; lon. 41.0^{mm}; p. 222.
3, 4. *Venericardia barbarensis* Stearns; lon. 15.0^{mm}; p. 214.
5, 6. *Venericardia ventricosa* Gould; inside and outside view of type specimen; alt. 15.0^{mm}; p. 216.
7, 9. *Miodon prolongatus* Carpenter; inside and outside view of typical specimen, from Middleton Island, Alaska; alt. 5.0^{mm}; p. 217.
8. *Venericardia borealis* Conrad; inside view; lon. 33.0^{mm}; p. 215.

PLATE XVII.

- FIGS. 1, 2. *Chione effeminata* Stearns; lon. 13.0^{mm}; p. 221.
3, 4. *Lucina aquizonata* Stearns; lon. 46.25^{mm}; p. 220.
5, 6. *Lucina filosa* Stimpson; lon. 40.0^{mm}; p. 220.





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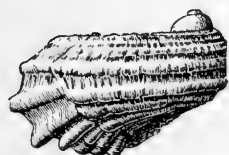
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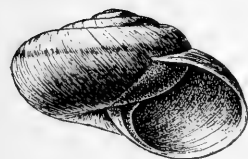
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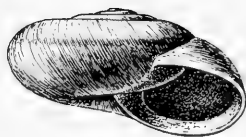
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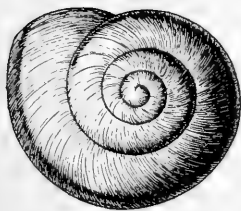
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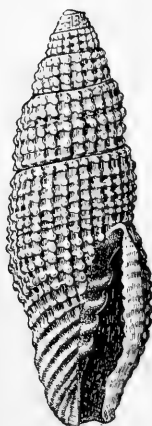
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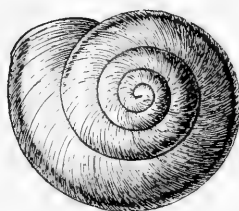
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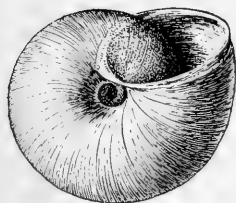
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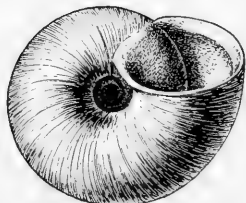
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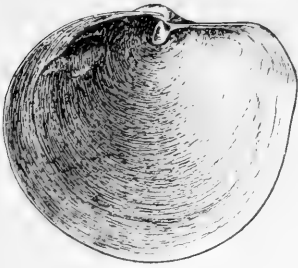
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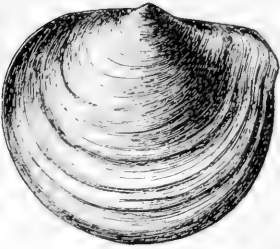
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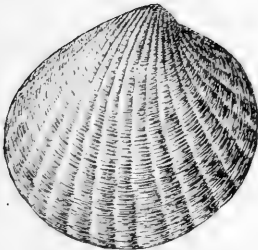
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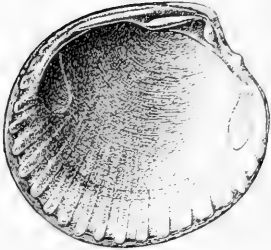
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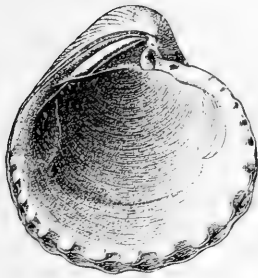
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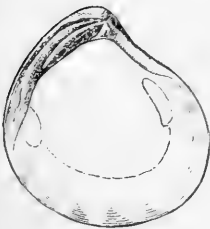
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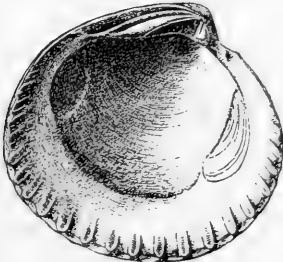
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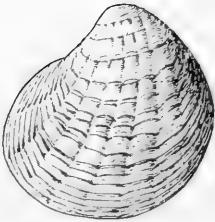
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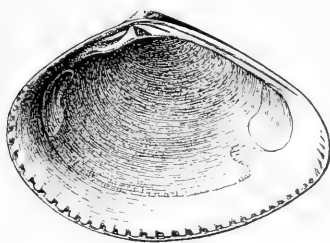
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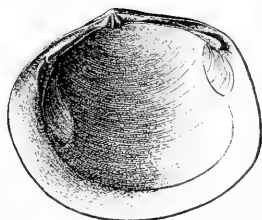
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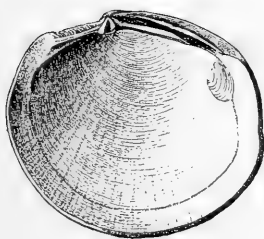
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DESCRIPTION OF TWO NEW SPECIES OF MAMMALS FROM MT.
KILIMA-NJARO, EAST AFRICA.

BY

FREDERICK W. TRUE,

Curator of the Department of Mammals.

Some weeks ago the National Museum received from Dr. W. L. Abbott the generous gift of a large zoological collection from the vicinity of Mt. Kilima-njaro, East Africa. The collection includes about ninety skins of mammals, and an equal number of skulls, representing about thirty-eight species. At least two of the species, an antelope and a tree-coney, are apparently undescribed, and it is my object at the present time to publish a description of these forms.

An account of the entire series of mammals, with illustrations of the forms not hitherto depicted, will be prepared at an early day.

The first species to be described is a brown pygmy-antelope, of the genus *Cephalophus*, from high altitudes in Mt. Kilima-njaro.

1. *Cephalophus spadix* sp. nov.

(Adult male, No. 18965.)—Size large. Naked rhinarium broadly triangular, rugose, completely encircling the nostrils. The portion external to the nostrils is broadest at their inferior-external angle.

A narrow band bordering the lip is sparsely covered with hairs, which are not sufficiently numerous to conceal the rugose integument.

Ears moderate, broad, obtuse; naked within, except on the margin and along two or three narrow lines. Hoofs of the fore and hind feet equal. Each moiety less than twice as long as broad at the base. False hoofs moderate, slightly less than one-third as long as the true hoofs.

Tail short, well haired on both sides, except a small triangular area at the base, which is naked.

Hair short, dense, appressed, and shining.

Color throughout dusky chestnut-brown, without spots or bands, and not lighter on the belly. Face, chin, and throat pale grayish brown. Hairs of the frontal crest bright chestnut at the base and tipped with black. Mingled with them are some hairs which are dusky throughout and others pure white. Anterior surfaces of the legs somewhat lighter than the posterior surfaces. A few white hairs above the hoofs and also on the rump. Tail dusky, except at the tip, where the hairs are nearly pure white throughout.

Skull elongate. Muzzle slender. Premaxillæ directed backward, touching the nasals by their superior rather than their posterior margin. Nasals very long, much produced anteriorly. Frontal region strongly convex. Suborbital pit nearly circular, as large as the orbit.

Horns $4\frac{1}{2}$ inches (114.3^{mm}) long; slender, straight, not thickened at the base in front. They are directed backward and lie below the plane of the upper surface of the skull.

Lower incisors separated by a wide space in the median line. Crowns long, inclined outward. Outer incisor more than half as broad as the middle incisor.

HABITAT.—High altitudes on Mt. Kilima-njaro, frequenting the highest points.—(Abbott.)

DIMENSIONS.*

	Inches.	mm.
Head and body	38	965.2
Tail, with hairs.....	$4\frac{1}{2}$	114.3
Fore-leg, hoof to knee	$6\frac{1}{4}$	158.7
Hind leg, hoof to hock.....	$9\frac{1}{2}$	241.3
Height of ear from occiput.....	$4\frac{1}{4}$	107.9

Skull.

	mm.
Greatest length.....	235.0
Basilar length, from occipital condyle to end of intermaxillæ.....	216.0
Length of nasals.....	95.0
Length of molar teeth	67.0
Greatest breadth of skull	104.0
Length of orbit.....	40.0
Greatest length of mandible	184.0
Breadth of left lower incisors and canine.....	13.0
Length of horns.....	114.3
Circumference of horn at base.....	75.0

2. *Dendrohyrax validus* sp. nov.

Size large, form robust, muzzle hairy as far as the upper angle of the nostrils. The space between the nostrils, a narrow border external to them, and a line from them to the margin of the lip, are naked. The ears are of moderate size, rounded, and nearly concealed by the fur in the dry skins.

Fur dense, soft, and crenulate.

Color of the upper surfaces cinnamon-brown, strongly shaded with dusky-brown or black, especially on the head. Feet dusky-brown. Under surfaces pale, clear cinnamon. Dorsal spot russet-brown.

The majority of the hairs of the back are grayish chocolate-brown at the base, with a subterminal ring of bright cinnamon color, and tips dusky-brown or black. Mingled with these are numerous longer, straight, shining hairs of a dusky-brown or black color throughout.

* From dry skin, No. 18965, ♂, adult.

The subterminal rings of the hairs of the forehead and cheeks are paler than on the back, and these parts have, therefore, a grayish tint.

Around the nostrils and eye and on the feet the hairs are dusky-brown. The ears are dusky-brown externally, and have a tuft of yellowish-white hairs on the upper part of the conch internally.

Hairs of the under surfaces grayish chocolate-brown in the basal half; terminal portion clear cinnamon-brown, varying to yellowish-white in some specimens, especially between the hind legs.

Skull.—Skull depressed, muzzle elongate, nasal bones rectangular, slightly expanded posteriorly. Orbit completed behind by the union of the processes of the malar and frontal bones.

Coronoid process of the mandible rectangular, inclined forward, forming an angle of 45° with the molars; its upper margin nearly in a line with the margin of the ramus posterior to the condyle.

DIMENSIONS OF THE BODY.*

Cat. No.	Locality.	Sex.	Head and body.	Fore foot.	Hind foot.	Ear from the occiput.
			mm.	mm.	mm.	mm.
18986*	Mt. Kilima-njaro	♂	513	45	64	14.5
18987	Taveta		588	46	59	12.5
18989	...do		470	42	58	15.5
18988	...do		520	48	64	13.5
18990	...do		500	42	59	13.0

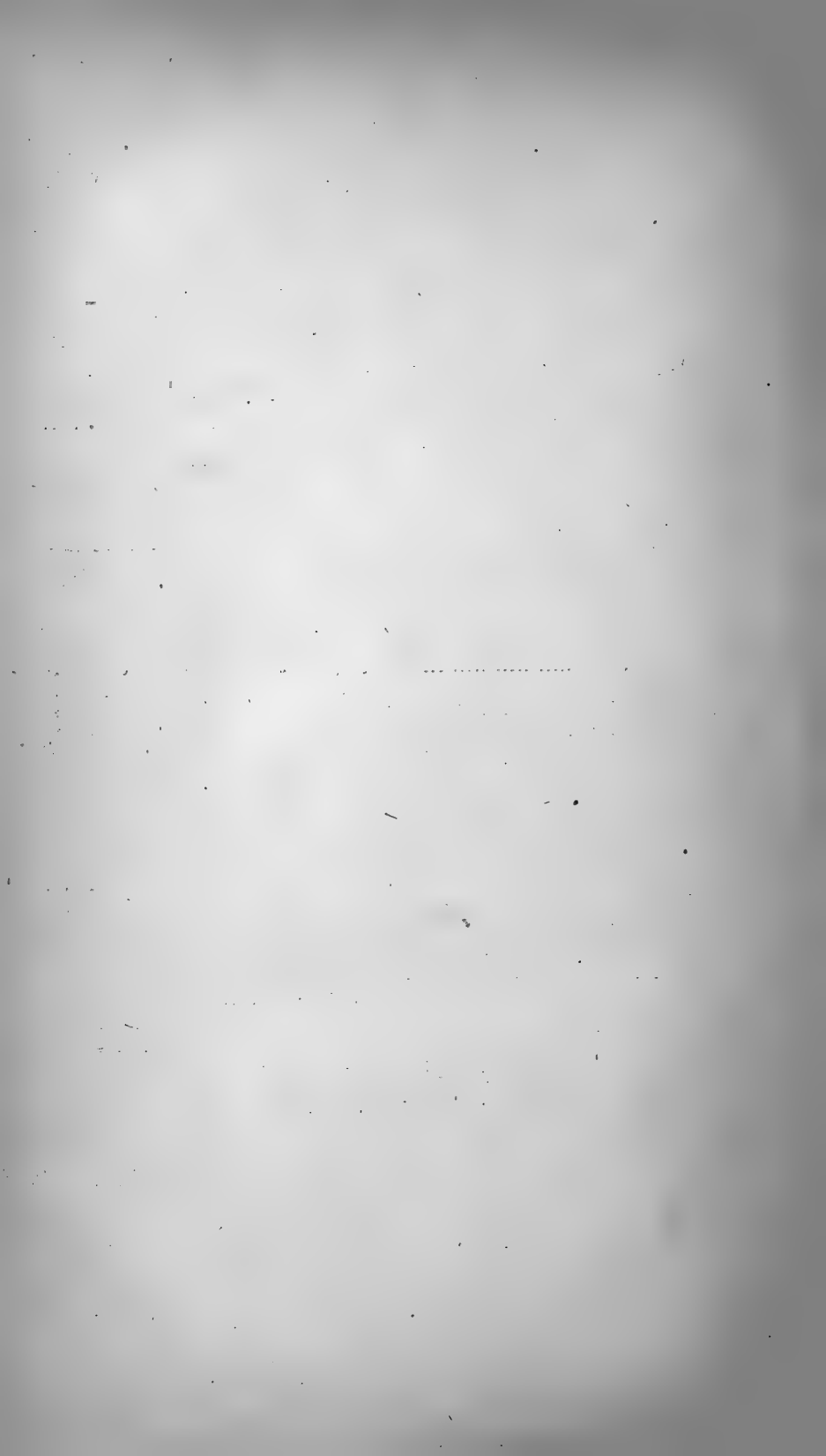
* Collected June 17, 1888.

Dimensions of skull No. ²⁵⁷⁹⁶~~18986~~, ♂, Mt. Kilima-njaro, June 17, 1888.

	mm.
Greatest length from premaxilla to occipital crest.....	95.0
Basilar length, from premaxilla to occipital condyle.....	89.5
Premaxilla to posterior end of palate	49.0
Greatest breadth of skull.....	51.0
Greatest length of nasals	25.0
Breadth of nasals (taken together) at distal end.....	12.0
Breadth of nasals at proximal end	19.0
Distance between extremities of postorbital processes of frontal.....	42.0
Length of molars	34.0

JULY 15, 1890.

* Taken from the dry skins, and therefore only approximately correct.



OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY MURÆNES-
OCIDÆ.

THEODORE GILL, M. D., PH. D.

The genus *Murcenosor* was taken as the type of a family by Professor Cope in his "Observations on the systematic relations of fishes," but without any indication of his reasons for considering it as such. The only information conveyed by him was that contained in the following synopsis:

- [illegible]

The characters thus indicated prove on comparison of the several types to be neither applicable nor distinctive. *Muranesox* appears nevertheless to represent a distinct family most nearly related to the *Congridæ* and whose characteristics are here given. These, however, must (as in the descriptions of other families) be regarded as simply provisional, and to be confirmed or modified by comparison with the characteristics of other genera. Whether any other genera belong to the family can not be definitely ascertained till their anatomy is known.

MURÆNESOCIDÆ.

Family synonyms.

Muraenesocidæ *Cope*, Proc. Am. Ass. Adn. Sc., 1871, p. 334, 1872.

Muraenesocidae Gill, Arrangement Fam. Fishes, p. 20, 1872.

Congridæ gen *Kaup et al.*

Congroidei gen *Bleeker*.

Muraenidæ gen *Günther et al.*

Subfamily synonyms.

Muraenesocina *Günther* Cat. Fishes B. M., v. 8, p. 20, 1870.

Congriformes murænesoces Bleeker, Atlas Ich. Ind. Neerland., v. 1, p. 19, 1864.

Muraenesocinae *Jordan & Gilbert*, Syn. Fishes, N. A., p. 357, 1882.

Diagnosis.

Enchelycephalous Apodals with the tongue not free, the branchio-
tegal membrane connecting the opposite sides below, the epiplaryngeals
reduced to one pair, and the hypopharyngeals linguiform and encroach-
ing on the fourth branchial arch.

Description.

Body typically anguilliform, with the caudal portion or tail moderately attenuated backwards, and with the anus in the anterior half of the length.

Scales absent.

Lateral line distinct, nearer the back than abdomen in front, about midway between the two for most of its length.

Head compressed, elongate, attenuate forwards, with all the bones invested in the skin.

Eyes within the anterior half of the head's length, entirely lateral, moderate, and covered by thin skin.

Nostrils lateral; the posterior considerably in advance of the eye, patulous, but with a raised border; the anterior tubiform and nearer the front of the snout than eye.

Mouth with the cleft deep and extending beyond the eyes.

Jaws rather slender; *maxillines* remote from the front of the anteal, with the clasping processes feeble and appressed only to the lower portion of the anteal in front of the posterior nostrils and far behind its head; each ramus has a broad horizontal ledge-like expansion behind under the orbits and is correspondingly depressed from above, and thence becomes compressed and dilated into oar-like expansions, overlapping and closely appressed to the lower jaw; *mandible* with the rami elongated and slender; each dentary has a well-developed coronoid and constitutes most of the ramus; the articular is exceedingly contracted and developed only as a posterior cap to the dentary round the articular condyle.

Teeth well developed, especially on the front and median line of the anteal; generally in three rows on the anteal and ledge of each maxillary, and with the teeth of the median row more or less enlarged; also generally in three rows on each dentary, and with the teeth of the median row enlarged.

Lips undeveloped.

Tongue rudimentary, not free.

Opercular apparatus moderately developed; *operculum* oblong and thin; *suboperculum* simulating a branchiostegal; *interoperculum* moderate, and mostly overlapped by the preoperculum; *preoperculum* well developed, but excavated by muciferous pores.

Branchiotremes in front of or lower than the inferior rays of the pectorals, rather large, and with the membrane in front emarginated by a deep sinus.

Branchiostegals in considerable number (about 17 to 23 pairs), extending along the ceratohyals and epihyals, and with the branchiostegal membrane well developed and connecting the bones of the opposite sides; the rays moderately bowed.

Dorsal, anal, and caudal confluent in one uninterrupted fin, with the

rays readily perceptible through the thin skin; dorsal commencing nearly above or in advance of the basis of the pectorals; anal commencing immediately behind the anus; caudal prominent.

Pectorals well developed, nearer the breast than back, with the rays distinct.

Branchial arches nearly complete, with well-developed glossohyal and long slender urohyal,* but with first and second basibranchials only ossified; the hypobranchials of the first three arches well developed and ossified, of the fourth and fifth suppressed; ceratobranchials and epibranchials of four pairs ossified; pharyngobranchials of first arch, rudimentary; of second, moderate; of third, expanded and connected also with fourth; of fourth,† developed as lamelliform epipharyngeals covered with cardiform teeth; hypopharyngeals elongated linguiform bones covered with cardiform teeth and dislocated so as to cover the basal portion of the ceratohyals of the fourth pair.

Interbranchial slits extended.

The characters which appear to distinguish the *Muraenesoces* best from the Anguillids and Congrids or Leptocephalids are the low position on the hyomandibular of the condyle for the operculum; the slender branchial arches and the development and position of the hypopharyngeals and epipharyngeals; the union of the opposite branchiostegals by the inferior branchiostegal membrane, and the want of freedom of the tongue. Whether the other genera that have been closely associated with *Muraenesox* (*Hoplunnis*, *Oxyconger*, *Neoconger*, *Nettastoma*, and *Saurenehelys*) are related to the family can only be determined by an examination of their skeletons. The species combined under the name *Muraenesox* are the only ones certainly possessed of the characters provisionally assigned to the family. The species generally united under the generic designation differ considerably, and have been distributed by Dr. Bleeker under two genera. It will be convenient at least to recognize them as subgenera, but a section not yet isolated, distinguished by the simply conic teeth, is as worthy of distinct rank as the two already named. Three sections of generic or subgeneric rank may therefore be recognized, viz:

* The basal half of the urohyal is invested in the membrane between the opposite branchiostegal arches, and from the lower surface, at the place of emergence upwards from the membrane, arises the ligament connecting with the anterior points of the scapular arch.

† It is inferred that the dentigerous epipharyngeal is the fourth pharyngobranchial, from the fact that it is the fourth pharyngobranchial or second epipharyngeal which is the largest in the *Anguillidae*. In that case it is the third pharyngobranchial which has widened and developed a process for the fourth epibranchial in *Muraenesox*, while the epipharyngeal is entirely dislocated from its normal position and its base of attachment transferred to the second epibranchial and third pharyngobranchial.

1. Murænesox *M'Clelland*, Calcutta Journ. Nat. Hist., v. 4, p. 408, 1843.
Type *M. cinereus* (Forsk).

Murænesocids with enlarged tricuspidate cultrate and acute teeth along the middle of the vomer (anteal) and compressed cultrate acute teeth in the middle row of the mandible.

2. Cynoponticus *Costa*, Fauna Napol. = *Brachyconger*, Bleeker Atlas Ich. Néerland. Ind., v. 4, p. 19, 1864.
Type *C. savanna* (Cuv.).

Murænesocids with enlarged tricuspidate, bluntly edged teeth along the middle of the vomer and little compressed bluntly edged and truncated teeth in the middle row of the mandible.

3. Congresox Gill = Murænesox sp., M'Clelland, Bleeker *et al.*
Type *C. talabon* = *Conger talabon* Cuv.

Murænesocids with enlarged and mostly acutely conic slender teeth along the middle of the vomer and similar teeth in the middle row of the mandible.

I have examined crania of *Murænesox** and *Cynoponticus*, but not one of *Congresox*. The first two genera differ in details but are much alike in cranial characteristics, and (contrary to the generic diagnosis of Bleeker) differ very slightly and only in degree in the contraction of the anteal behind its head.

* That of the Murænesox (*M. cinereus*) is imperfect and broken behind.

ON THE FAMILY RANICIPITIDÆ.

BY

THEODORE GILL, M. D., PH. D.

(With Plate XVIII.)

In 1872, I named the family *Ranicipitidæ* and in 1884 defined its external characteristics. Not then having a skeleton, however, some doubt was entertained as to its relations as well as standing. A skeleton, since made by Mr. F. Lucas, enables me now to give the full characteristics. The family proves to be nearly related to the *Gadidæ*, but presents some remarkable peculiarities, especially the enlarged system of suborbital bones and the preceding nasal as well as succeeding supraopercular bones.

In 1837, Dr. Richard Parnell first drew attention to the divergence of the genus *Raniceps* from the true *Gadidæ*.* His remarks were as follows:

The œsophagus is short and wide; the stomach is of an oval form, and the intestines are entirely destitute of cœca. In this last respect the tadpole fish is an exception in the family *Gadidæ*, where the cœcal appendages are numerous, so as to form one of the principal characters of that family; and it is evident that Cuvier had not been acquainted with its anatomical structure, for had he been so he would not have placed this fish in the family in which it now stands. A new family ought to be constituted for it, inasmuch as it differs from the *Gadi* in having the head covered with scales, as well as in having the intestines free from cœca.

The intestines are *not entirely* free from cœca, inasmuch as two small ones are present, as in many *Brotulids* and *Lycodids*, nor is the extension of scales on the head a character of family value. Nevertheless, the physiognomy is so peculiar as to excite attention and the characters revealed by dissection warrant the isolation of *Raniceps* in a special family.

In 1863, the present writer† remarked that “from the *Gadoids* I am disposed to separate the genera *Raniceps* of Cuvier and *Bregmaceros* of Thompson, the former of which has been already considered by Dr. Parnell as the type of an independent family, and to similar rank the latter is probably likewise entitled.” In 1872 I named the family and in 1884 diagnosed it. I now give an amended diagnosis and a full description of the family characters.

Contributions to the Ichthyology of the Firth of Forth. No. II.—The Tadpole Fish. By Richard Parnell. < Mag. Zool. and Bot., 1, pp. 344-347 (347), pl. 1.

†Descriptions of the genera of Gadoid and Brotuloid Fishes of Western North America. By Theodore Gill. < Proc. Acad. Nat. Sc., Phila., 1863, pp. 242-254 (243).

RANICIPITIDÆ.*

Family Syn.

- =New family [unnamed] *Parnell*, Mag. Zool. and Bot., v. 1, p. 347 (indicated), 1837.
 =Ranicepitidæ *Gill*, Arrangement Fam. Fishes, p. 2 (named only), 1872.
 =Ranicepitidæ *Gill*, Proc. Acad. Nat. Sc., Phila., 1884, p. 173 (diagnosed), 1884.
Jugulaires gen. *Duméril*, 1806.
Gadinea gen. *Rafinesque*.
Gadoides gen. *Cuvier*.
Gadidæ gen. *anct. pl.*
Gadoidei gen. *Bleeker*.
Gadi gen. *Fitzinger*.

Subfamily Syn.

- =Ranicipini *Bonaparte*, Trans. Linn Soc. London, v. 18, p. 298 (diagnosed), 1841.
 =Ranicipini *Bonaparte*, Cat. Met. Pesci Europei, p. 6.*.
 =Ranicipitini *Bonaparte*, Consp. Syst. Ich., 1850.

Diagnosis.

Gadoidea with a moderate caudal portion coniform behind and with caudal rays procurent, submedian anus, a chain of muciferous bones consisting of the enlarged nasal bones connected at the middle, followed by the suborbitals, the fourth of which is extended backwards and connected with a special system of dermal bones over the operculum and continued on the humeral region behind; the hyomandibular obliquely extending forwards and upwards, and with the posterior limbs of the pelvis rod-like.

Description.

Body elongated, antroirsiform, depressed forwards, compressed backwards, graduated from the head to the caudal, and with the caudal peduncle slender and continued into the caudal; anus antemedian.

Scales small and regularly imbricated.

Lateral line indistinct, moderately high in front, thence decurven and obsolete behind.

Head wide and depressed, with the snout roundish or declivous.

Eyes within the anterior half of the head, mostly lateral, but also inclined upwards.

Nostrils double; the anterior tubular, the posterior with a raised margin; the two separated by a moderately wide bridge.

Mouth with the cleft semicircular, quite deep and slightly oblique or nearly horizontal; lower jaw closing within upper.

Jaws of the gadoid type; each *intermaxilline* with a short posterior process and a thin crest near the distal end; the *supramaxilline* slightly decurved to the end and with a subterminal inferior process.

Teeth conic, curved and cardiform on the jaws and vomer.

*Ranicipitidæ < *Raniceps*, *g. Ranicipitis* (in analogy with *anceps*, *ancipitis*, *biceps*, *bicipitis*) + *idæ*.

Lips thick; the lower divided at the chin by a wide frænum.

Tongue well developed, thick, and slightly free all around.

Periorbitals concealed by the skin, enlarged, and peculiarly developed; first connected with the nasal, fourth widening and extending backwards to connect with a system of supraopercular bones, and succeeding periorbitals (fifth, etc.) procurrent to the orbits.

Opercular apparatus well developed; *operculum* a subtriangular lamina with an antero-posterior internal rib (above which there is an expansion to connect with a system of supraopercular bones) and also with an anterior inferior marginal rib; *suboperculum* and *interoperculum* normally laminar; *preoperculum* normally bilaminar and crescentiform.

Branchiotremes (*branchial apertures*) ample, extending forwards and with the branchiostegal membrane deeply incised.

Branchiostegals seven; the inner three attached to the inner side of the *ceratohyal*, the rest outside, the outermost to the epibyal.

Dorsalis double; the anterior fin rudimentary or very small and separate; the posterior very long.

Anal elongated, not shorter than the dorsal.

Caudalis distinct, with its external rays procurrent above and below the caudal peduncle.

Pectorales moderately developed.

Ventrals anterior, separated by a quite wide interval, narrow, but with about seven rays each.

The skeleton exhibits all the characteristics of a typical Gadoidean* and the principal modifications consist of the lateral extension of the cranium, and especially the prefrontal and pterotic, and modifications of the suspensorium and pelvis.

The *hyomandibular* is especially distinguished by its development at almost a right angle with the metapterygoid and its extension forwards considerably beyond the quadrate, as well as for the oblique trend of the large fenestra for the posterior branch of the facial nerve. The fenestra for the anterior branch of the facial nerve is concealed from direct observation by the preoperculum, the symplectic being pushed backwards. The metapterygoid alone intervenes between the hyomandibular and the quadrate. The relation of the hyomandibular, quadrate, symplectic and metapterygoid to each other and the neighboring bones, in fact, contrast strongly with those of any true Gadid known to me, and are probably co-ordinates of the abbreviation of the cranium.

The *pelvic bones* are reduced by the attenuation of its limbs; the articular portion is narrow but well defined, the interno-posterior extension or limb rod-like and short, and the interno-anterior extension or limb longer and oar-like.

There is but one genus, so far as known, which appears to belong to

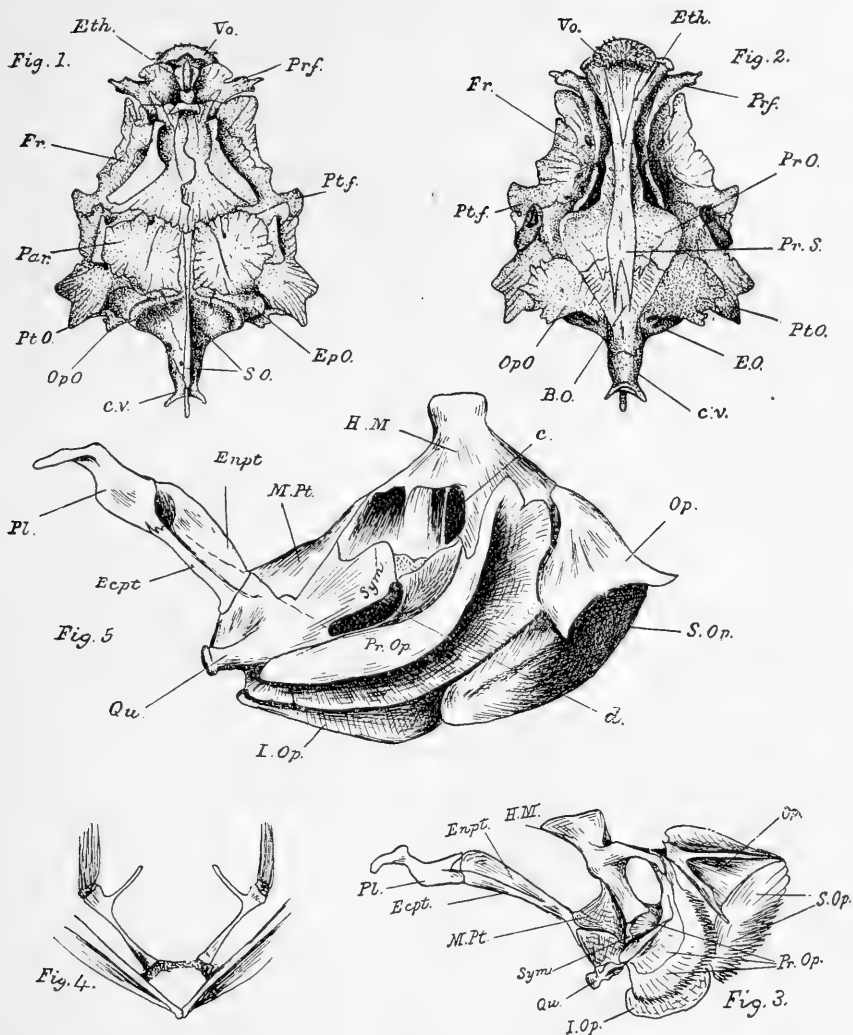
* Gadoidea Gill, Proc. Acad. Nat. Sc., Phila., 1884, p. 170.

the family, and that genus has only a single species, confined to the seas of northern Europe.

RANICEPS Cuvier Rigne Animal, t. 2, p. 217, 1817=*Batrachocéphalus* Holböll Göth. Vet. Selsk N. Handlingar, v. 3, p. 39.

The proper name of the species appears to be *Raniceps raninus* (= *Blennius raninus* Linn, Syst. Nat., ed. x, p. 258, 1758). Dr. Günther, however, has called it *Raniceps trifurcus* (= *Gadus trifurcus* Walbaum).

I am indebted to my friend, Dr. R. W. Shufeldt, for the original drawings of the skull of *Raniceps*, and the copy of the suspensorium and its appendages of the haddock (*Melanogrammus aeglefinus*) derived from the Proceedings of the Royal Dublin Society for 1884 (The Osteology and Arthrology of the Haddock, by H. St. John Brooks)



FIGS. 1-4. *Raniceps raninus*: (1) Skull, from above; (2) skull, from below; (3) suspensorium and opercular apparatus; (4) pelvis and proscapula.

FIG. 5. *Melanogrammus aeglefinus*: Suspensorium and opercular apparatus.

B.O. Basi-occipitine.
c. Fenestra for passage of posterior branch
of facial nerve.
C.V. Cervical vertebra.
d. Fenestra for passage of anterior branch
of facial nerve.
Ecpt. Ectopterygoid.
Enpt. Entopterygoid.
E.O. Exoccipitine.
Ep. Epitotic.
Eth. Ethmoid or prosthmoid.
Fr. Frontine.
H.M. Hyomandibular.
I.O. Interoperculum.

M.P. Metapterygoid.
Op. Operculum.
Op.O. Opisthotic.
Par. Parietine.
Pf. Prefrontal or ectethmoid.
Pl. Palatine.
Pr.S. Parasphenoid.
Ptf. Postfrontal or sphenotic.
Pto. Pterotic.
Q. Quadrate.
S.O. Suboperculum.
Sym. Symplectic.
V. Vomer or anteal.



THE OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY SIMENCHELYIDÆ.

BY

THEODORE GILL, M. D., PH. D.

In 1878 several specimens of a remarkable fish, with an anguilliform body but with a head very unlike that of an eel, were received at the Smithsonian Institution. So different was the fish from an eel that Messrs. Goode and Bean were doubtful as to its relations and referred it to me to determine its affinities, kindly resigning to me the privilege of naming and describing it. I determined it to be the representative of a peculiar family, but to be otherwise a true eel or apodal, and drew up a preliminary description, which was published by Messrs. Goode and Bean in "a list of the fishes of Essex County, including those of Massachusetts Bay," contributed to the "Bulletin of the Essex Institute."* The new type was introduced in the following terms: †

This strange form has much of the physiognomy of a *Carapus* (*Gymnotus*), and has a short, blunt snout, but is a true Apodal and has an eel-like tail. The branchial apertures are short longitudinal slits on each side of the throat below the pectorals, which are well developed; the dorsal commences about a head's length behind the pectorals, the anal considerably in advance of the second half of the total length. The skin has scales like those of *Anguilla*, linear, scattered, and disposed at right angles to each other. The head is very short; the premaxillaries and maxillaries of each side consolidated into a single piece; and separated from that of the opposite side by the ethmoid, and provided with lamelliform posterior margin and an expanded antero-terminal process; mandible very deep; teeth blunt, uniserial; the operculum saber-shaped. The type appears to belong to the suborder of *Enchelecephali*. The single species (*Simenchelys parasiticus*) is dark brown colored in life, and individuals have been found burrowing into the flesh of the halibut.

After too long an interval, I supplement the diagnosis thus given by the following detailed description of the characters.

Meanwhile the name has appeared in several catalogues and works, and the family has been adopted by Messrs. Goode, Bean, and Jordan.

In 1889 numerous examples of an anguilliform fish were taken in

* "*Simenchelys parasiticus* Gill, MS. Pug-nosed eel. Several specimens of an undescribed eel-like fish were obtained on the halibut trawls, on the off-shore banks." Goode and Bean, *op. cit.*, p. 27.

† Gill MSS. in *op. cit.*, v. 11, p. 27, 1879.

‡ The suggestion that each jaw bone represented an intermaxillary and supra-maxillary (borrowed from Prof. Cope) was not more happy than previous guesses.

nets at the Azore Islands at depths varying from 844 to 2,000 meters by the yacht *Hirondelle*, under the auspices of the Prince of Monaco.* These were subsequently determined to belong to a peculiar form called by Dr. Robert Collett *Conchognathus Grimaldii*. A comparison of the description given indicates plainly that the supposed new generic type is identical with *Simenchelys*. It has the same scaly skin, short truncated head, small mouth, acrodont teeth, inferior branchial slits, and large "conchiform" lower jaw, reference to which is conveyed in the generic name.†

SIMENCHELYIDÆ.

Synonyms as family names.

- =Simenchelyidæ Gill. (with Goode & Bean), Bull. Essex Inst., v. 11, p. 27, 1879.
- =Simenchelyidæ Gill, Standard Nat. Hist., v. 3, p. 107, 1885.
- =Simenchelyidæ Jordan, An. Rep. Com. Fish. for 1885, v. 13, p. 844, (Sep., p. 56, 1885) 1887.
- =Anguillidæ s. f. Jordan & Gilbert, 1882.
- =Murænidæ gen. Günther, Collett.

Synonym as subfamily name.

- =Simenchelyinæ Jordan & Gilbert, Syn. Fishes N. Am., p. 357, 1882.

Diagnosis.

Apodal fishes with a blunt snout, transverse anterior mouth, massive jaws with an acrodont dentition, and inferior longitudinal branchial slits moderately far apart from each other.

Description.

Body stoutly anguilliform, moderately compressed anteriorly, much compressed towards end of tail, and with the anus little in advance of the middle of the total length.

Scales small, linear, arranged in small groups obliquely and at right angles to those of the neighboring groups, well embedded in the skin.

Lateral line distinct, quite high up, and on each side of the back in front, but gradually declining and near the middle behind.

Head small, compressed, ovate laterally, obtuse in front, with all the bones invested in the skin.

Eyes about or within the anterior third of the head's length, entirely lateral, small, and covered by thin skin.

Nostrils lateral; the posterior close in front of the eye, the anterior on the front of the snout and subtubular.

* Nombreux exemples toujours pris dans les nasses au large des îles de Graciosa, Fayal, San Jorge, Pico, Florès, et Corro, Açores, Juillet et Août, 1888. Profondeur : 844^m à 2,000^m. *Op. cit.*, p. 124.

† Diagnoses des poissons nouveaux provenant des campagnes de l'*Hirondelle* par Robert Collett < Bull. Soc. Zool. de France pour 1889, pp. 122-125 (1.—Sur un genre de la famille des *Murænidæ*, pp. 123-125).

Mouth with the cleft transverse and slightly extending laterally backwards.

Jaws very stout; *maxillines* approximated to the front of the anteal, with the clasping processes narrow, selliform, and appressed closely and obliquely to the sides of the anteal behind its head; each has a broad, ledge-like extension extending obliquely upwards within along most of the length, and behind expanding downwards into a cleaver-shaped process obliquely truncated behind; *mandible* with the rami very stout, and deep, each dentary has the coronoid process well developed, and the inferior edge is strongly bowed downwards; articular extending forwards on the outer surface of the mandible scarcely in advance of the condyle.

Teeth blunt, uniserial, on the edge of the jaws and acrodont.

Lips completely suppressed.

Tongue large, filling the whole floor of the mouth, with its margin free and bevelled, having a trenchant upper edge.

Periorbital bones almost membranous.

Opercular apparatus peculiarly developed; *operculum* falciform, inserted nearly midways on the hyomandibular and decurved downwards and then upwards in harmony with the branchiostegal rays; *suboperculum* below and parallel with the operculum; *interoperculum* lamelliform and widened upwards towards its junction with the operculum; *preoperculum* well developed and closely appressed to the suspensorium.

Branchiotremes inferior and manifest as longitudinal slits moderately distant from each other.

Branchiostegals in reduced number (8-9), moderately stout and partly widening towards their ends, long, and recurved over the operculum.

Dorsal, *anal*, and *caudal* confluent into an uninterrupted fin, with the rays readily perceptible through the skin; *dorsal* commencing not very far behind the head; *anal* close behind the anus; *caudal* prominent backwards.

Pectorals well developed, near the breast and with narrow bases and median branched rays.

Branchial arches nearly complete, with a styliform glossohyal and a much abbreviated urohyal, and with the first and second basibranchials ossified; first and second hypobranchials ossified; third cartilaginous; fourth suppressed; ceratobranchials and epibranchials of four pairs ossified; pharyngobranchials of three (?) pairs connected with epibranchials; those of the last pair developed as thin dentigerous epipharyngeals dislocated towards the ceratobranchials; hypopharyngeals with narrow dentigerous surfaces and closely appressed to the fifth branchial arch.*

* The branchial apparatus described is imperfect and the description may possibly be defective or erroneous.

The family is well marked by the peculiar form of the head and the inferior *longitudinal* branchial fissures, as well as by the massiveness of the jaws and branchiostegals. Only one genus is known, viz:

SIMENCHELYS Gill, with Goode & Bean, Bull. Essex Inst., v. 11, p. 27, 1880 = *Conchognathus* Collett; Bull. Soc. Zool. France, 1889, p. 122.

Type *S. parasiticus* Gill.

The question naturally arises whether the *Simenchelys parasiticus* and *Conchognathus Grimaldii* are distinct. So far as can be judged from the description of Dr. Collett, this question must be answered in the negative. The measurements of two specimens of nearly the same size correspond closely enough for specific purposes except as to height. That measurement for the *Conchognathus Grimaldii* has evidently been obtained from a specimen with a very full belly* and not at the pectoral or anal region. The measurements from an American specimen are subjoined for comparison with measurements of an Azorean one given by Dr. Collett.

Measurements.

	Ameri- can.	Azores.
	<i>Mm.</i>	<i>Mm.</i>
Total length	419	417
Snout to branchial slit	34	37
Snout to dorsal	64	67
Snout to anus	184	180
Height of trunk:		
At pectoral	30	.....
At belly	33	40
At anus	23	.....
Width of mouth	11	11
Diameter of eye-ball	6	6
Length of pectoral	18	15
<i>Numbers.</i>		
Teeth .....	.....	28
Branchiostegals .....	.....	8
Pectoral rays	15	14

*Le corps est comprimé; le museau est tronqué; le ventre un peu pendant, très dilatable.—Collett, op. cit., p. 124.

THE CHARACTERISTICS OF THE DACTYLOPTEROIDEA.

BY
THEODORE GILL, M. D., PH. D.

(With Plate XIX.)

The Dactylopterids, or mail-cheeked fishes known as the flying gurnards, or, more vaguely, flying-fishes, so celebrated among navigators, and of which we have so many accounts in their writings, have been generally placed in the family Triglidae or with related forms by others associated with those fishes. They differ, however, much more than do the *Triglidae* and *Peristedidae* among themselves. In the words of Cuvier and Valenciennes, "it is even with difficulty that we are able to find any other character common to all of them than the extent of the casque which protects their head, but even this casque has an entirely different form, it is long and wide, but at the same time flat and little elevated. The snout is short and destitute of prominences. The enlarged suborbital does not cover the entire cheek and articulates in a movable manner with the preoperculum, so that the latter can spread out more than in the *Triglidae*, and thus the fish can avail itself in its defense of the enormous spine which arms the inferior angle of the bone. The operculum, on the contrary, is not spinous. The teeth of the Dactylopterids are small and paved, and they exist only on the jaws and not on the vomer or palatines. Their branchial apertures are but little open, and there are only six rays in their membrane.* They have only four

* The exact words of Cuvier and Valenciennes (v. 4, pp. 114, etc.) are as follows:

"Ces poissons, si célèbres parmi les navigateurs, et dont tant de relations font l'histoire, ont été généralement placés dans le genre des trigles; mais ils en diffèrent beaucoup plus que les trois sous-genres dont nous venons de parler ne diffèrent entre eux: c'est même à peine si l'on pourrait leur trouver d'autre caractère commun que l'étendue du casque qui garantit leur tête; encore ce casque a-t-il une tout autre forme: il est long et large, mais plat et peu élevé. Le museau est court et sans prominences. Le sous-orbitaire ne couvre pas toute la joue et s'articule d'une manière mobile avec le préopercule; en sorte que celui-ci peut s'écarter plus que dans les trigles, et que le poisson peut profiter pour sa défense d'une énorme épine qui arme l'angle inférieur de cet os. L'opercule, au contraire, n'est pas épineux. Les dents des dactyloptères sont en petits pavés, et ils n'en ont qu'aux mâchoires seulement, et non au vomer ni aux palatins. Leur ouïes s'ouvrent peu, et il n'y a que six rayons dans leur membrane. Il n'y en a que quatre dans les ventrales; circonstance très-rare parmi les acanthoptérygiens. Les pectorales n'ont point de rayons libres; mais elles

soft rays in the ventrals, a characteristic very rare among the acanthopterygians. The pectorals have no free rays, but they are deeply divided into two parts, an anterior of moderate length and with few rays, and a posterior almost as long as the body and whose rays are doubled, so that they are carried to the number of nearly thirty. When this part spreads out, it becomes as wide as long, and it is by means of the extensive surface it presents that the fish can raise itself into the air and sustain itself therein for some moments."* Such are essentially the words of Cuvier and Valenciennes respecting the Dactylopterids, published sixty years ago. Instead of improving upon this knowledge and obtaining truer conceptions of the forms in question, subsequent naturalists have fallen back, and it would appear from the comparatively recent literature that the Dactylopterids were considered to be very closely related to the Triglids and the Peristediids. Indeed, they had been universally associated with one or both of those types in the same family until 1885. In that year I separated them as a distinct family, being convinced that the characters which appeared on the surface must be the expressions of fundamental structural peculiarities. I was not prepared, however, to find the differences between the Dactylopterids and the fishes with which they had been associated so great as they appeared on a critical examination of the osteology. The words of Cuvier and Valenciennes were thus found to be applicable with even greater force than they had anticipated. The Dactylopterids not only represent a peculiar family, but, so different from all others are they, they must be regarded as representatives of a distinct superfamily having a number of remarkable peculiarities. This superfamily may be defined as follows:

DACTYLOPTEROIDEA.

Craniomous fishes with the postemporals suturally connected with the posterior bones of the cranium and with the upper surface forming a large portion of the roof of the cranium; infraorbital chain well developed but leaving a wide interval between the posterior bones and the preoperculum; the anterior or preorbital bone elongated and extending backwards to and uniting with the fourth; the second and third bones shoved out of the orbital margin by the junction of the first and fourth; the second depressed below the fourth, and the third much reduced and manifested as a special bone (pontinal) bridging the interval between the second suborbital and the antero-inferior angle of the preoperculum; intermaxillines with well-developed ascending pedicles

se divisent profondément en deux parties, une antérieure, de longueur médiocre et de peu de rayons, et une postérieure, presque aussi longue que le corps, et dont les rayons se dédoublent; ce qui en porte le nombre à près de trente. Lorsque cette partie s'étend, elle devient aussi large que longue, et c'est au moyen de la grande surface qu'elle présente que le poisson peut s'élever dans l'air et s'y soutenir quelques instans."

* See p. 3 a.

gliding into the cavity between the anteal (vomer) and prosethmoid; pharyngeals partially developed, the hypopharyngeals broadly triangular and separate; the epipharyngeals well developed on each side; myodome undeveloped, the cranial cavity mostly closed in front by extension from the subtectals (orbitosphenoids) and from the prootics and parasphenoid which are suturally connected with each other; the prosethmoid and anteal entirely disconnected, leaving a capacious rostral chamber opening backward mesially in the interorbital region; vertebræ much compressed, with special spiniform processes extending from the dorso-lateral and ventro-lateral surfaces of the centra; ribs directly articulated with the centra; scapular arch abnormally developed; proscapula with lateral expansions extending inwards; hypercoracoid small; hypocoracoid enlarged, uniting by large surface with the hypercoracoid and proscapula, and with a long process extending down towards the symphysis, leaving a wide interval between it and the proscapula; actinosts graduated and mostly connected with the hypercoracoid.

DACTYLOPTERIDÆ.

Synonyms as family names.

- < *Dactipli Rafinesque*, Indice d' Ittiol. Siciliana, p. 28, 1810.
= *Dactylopteridæ* or *Cephalacanthidæ* *Gill*, Standard Nat. Hist., v. 4. p. 252, 1885.
= *Cephalacanthidæ* *Jordan*, Man. Vert. North. U. S., 5 ed., p. 151, 1888.
< *Dactylopteridæ* *Lydekker*, Man. Pal., by Nicholson and Lydekker, v. 2, p. 1006, 1889.
= *Dactylopteridæ* *Cope*, Am. Nat., v. 23, p. 861 (name only), 1890
Trigloidei gen. *Bleeker*.
Triglidæ s. f. *Kaup et al.*
Cataphracti gen. *Günther et al.*

Synonyms as subfamily names.

- = *Dactylopterinæ* *Gill*, Cat. Fishes, E. Coast N. Am., p. 43, 1861.
= *Dactylopterinæ* *Kaup*, Archiv. f. Naturg., 1873, I, pp. 79, 84.
> *Cephalacanthinæ* *Kaup*, Archiv. f. Naturg., 1873, I, pp. 79, 84.
= *Dactylopterinæ* *Jordan & Gilbert*, Syn. Fishes N. Am., p. 732, 1882.

Description.

Body elongated and antrorsiform or slightly subfusiform, widening towards the head.

Anus submedian.

Scales hard, crenulated at their margins and enlarged at each of the angles of the base; those of the back and sides surmounted each by a longitudinal finely crenulated crest, the crests being very regularly disposed and so joined as to form trenchantridges which extend in a straight line the length of the fish, and of which the median lateral extend as far as the caudal. (C. V.).

Head parallel piped, oblong, incased with a bony casque, whose upper surface is derived partly from a dermal ossification which is incongruous

with the true bones; with the posterior lateral limbs of the casque, composed of the post-temporal and the connecting bones, projecting backwards in spiniform extensions on each side of the first dorsal fin.

Eyes mostly in the anterior half of the head, entirely lateral, and widely separated from each other.

Nostrils double, the two openings separated by a narrow bridge and inclosed in a common cavity in the casque above the preorbitals.

Suborbitals peculiarly developed, and with a free peripheral margin except at the pontinal; the preorbital very long, extending forwards and articulated with or nearly meeting its fellow of the opposite side, articulating behind with two bones, one above its angle (the fourth suborbital) forming most of the margin and floor of the orbit, the other (the second suborbital) inferior entering into the lower margin of the head; the latter articulates with a small special bone (the third suborbital or pontinal) which articulates with the inner angle of the preoperculum. Behind the orbit is a small, rather narrow postorbital connected with the sphenotic.

Opercular apparatus peculiar; the *operculum* small, flexible, subcircular or subtriangular, and covered with scales; *suboperculum* almost membranous, mostly concealed, and partly behind and below the operculum; *interoperculum* reduced to a small bone connected by ligament with the lower jaw, and remote from the interoperculum, mostly folded under the anterior margin of the preoperculum.*

Preoperculum enormously developed, dividing into two long narrow branches, a subvertical and a horizontal, and terminating behind in an elongated spine continued from its horizontal and underlying the pectoral fin.

Mouth small, opening directly under the snout, and with its cleft nearly parabolic.

Jaws normally developed; the intermaxillines with moderately elongated pedicles, compressed and converging behind, and with a broad dentigerous surface in front; the supramaxillines forming the lateral borders of the mouth, with the sellæ convex on the anterior surface and fitting into the concave surface of the intermaxillines, and with the posterior limbs but moderately expanded.

Teeth pisiform or obtuse and in bands on the jaws, but none on the palate.

Lips slightly fleshy.

Tongue small, reduced to a smooth, narrow, fleshy convexity of the floor of the mouth.

*Cuvier and Valenciennes wrongly describe the suboperculum and interoperculum as disappearing almost at the membrane. Their words are, "le sous-opercule et l'interopercule disparaissent presque dans la membrane" (p. 123). The interoperculum, however, has its normal relations with the lower jaw, and, although small, is distinctly developed.

It was correctly determined by C. Dareste, in 1872 (*Comptes Rendus Acad. Sc.*, 1872), and by Sorensen (*Naturhist. Tijdschr.*, 1884, pp. 75-78).

Branchial apertures small, vertical, mostly in front of the anterior bases of the pectorals, and consequently separated from each other by a very wide isthmus.

Branchiostegal rays six, three perceptible in the smooth, movable portion of its membrane, the fourth quite straight, enveloped in the part of the skin by which the membrane unites with the throat, and the two others concealed by the skin of the throat and by the scales with which it is furnished. (C. V.)

Dorsal fins two, the anterior with six or eight heteracanth spines, the foremost two of which are generally more or less detached; the posterior fins with only eight to ten rays, most of which are simply articulated and rather short; between the two fins is a compressed lancet-like spine, immovably connected with the interspinal below.

Anal fin opposite and nearly coterminous with the second dorsal, short, and with only six articulated rays.

Caudal fin emarginate, with its lobes nearly equal and with few rays, *e. g.*, seven or eight complete and two unbranched or rudimentary above and two or three below.*

Pectoral fins greatly specialized, expanding in a horizontal plane and composed of two distinct portions; an anterior or upper small, and an inferior or posterior enlarged portion, the former composed of five or six rays, the latter of numerous long and slender unbranched rays, and a number of short graduated ones forming a kind of axillary fringe; all connected by membrane which is but slightly emarginated about the middle between each pair of rays. The fins are underlaid by the very elongated spines of the preoperculum.

Ventrals thoracic, separated by a narrow interval, and composed of a spine and four unbranched rays, the innermost of which are short and slender.

Branchiæ complete and with the last arch separated by a cleft from the hypopharyngeals and œsophagus.

Branchial rakers rudimentary or absent; *pharyngobranchial* bones three on each side; the third enlarged and denticulate (*epipharyngeal*), the other rudimentary and edentulous.

Pseudobranchiæ developed.

It will appear from this description, when compared with those of the Triglidae and the Peristediidae, thus the Dactylopteridae differ in almost all respects from those forms with which they have been associated, and in fact the only reason for ever having brought them together is the fact that both have a head furnished with a casque, or armed, but, as already indicated, this casque is extremely different in the two types. Possibly another character is that there is a good deal of red about the body, for, absurd as such a cause would be, it has evidently influenced

* The formula may be 1 (small, simple) + 1 (large, simple) + 4 (branched) + 3 (branched) + 1 (large, simple) + 2 (small, simple).

various writers in making approximations of fishes. Although Cuvier and Valenciennes had correctly described the pectorals sixty years ago, later writers have reversed the two parts and called the small anterior portion the lower, and the posterior or inferior the upper portion of the fin. Thus Dr. Günther, in the second volume of the "Catalogue of the Acanthoptergzian fishes in the British Museum" (p. 221), has described, himself italicizing the characteristics, "*Pectoral very long (organ for flying), with the lower portion detached and shorter.*" The same view has been taken by Professors Jordan and Gilbert, who have evidently followed Dr. Günther, in the "Synopsis of the fishes of North America" and in the Manual of the vertebrates of the northern United States, by Jordan. Dr. Lütken had shown the error of such a view, and Dr. Günther, in his "Introduction to the study of fishes," has corrected his former error. Looking at the fish, one can not help wondering that such an error could ever have been made, and it was probably due to some false idea of an analogy between the small portion of the fin with its few rays and the three detached rays of the Triglidae or the two of the Peristediidae. A very slight consideration of the morphology of the fin, however, would have sufficed to have prevented such a blunder.

The only recognized genus of the family is *Dactylopterus*, which has received various names.

DACTYLOPTERUS.

Synonyms.

Pungitius *Linnæus* Mus. Ad. Fried., p. 74, 1754.

Cephalocanthus *Lacépède*, Hist. Nat. Poissons, t. 3, p. 323 (Young) 1801.

Dactylopterus *Lacépède*, Hist. Nat. Poissons, t. 3, p. 325 (Mature) 1801.

Dactylophorus *Swainson*, Nat. Hist. Fishes, etc., v. 2, pp. 55, 179, 262, 1839.

Gonocephalus *Gronovius* Syst. Ich., Gray ed., p. 106, 1854.

Cephalacanthus has been adopted in place of *Dactylopterus* by a few because it happened to be printed two pages in advance of the latter, but, while it is a much better name, the reason for adopting it is insufficient as the two names were evidently published at the same time and *Dactylopterus* has been almost universally adopted.

Dactylophorus was simply the result of a misreading or misapprehension by Swainson, and *Dactylopterus* is elsewhere used by him in the same work (v. 1, pp. 17, 27; v. 2, pp. 415-419*).

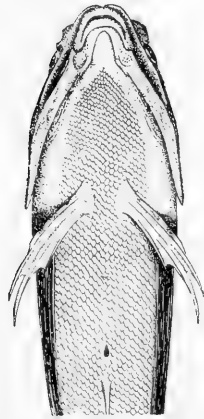
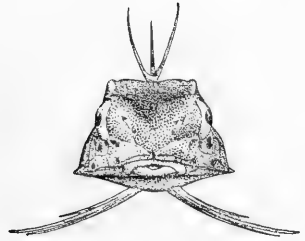
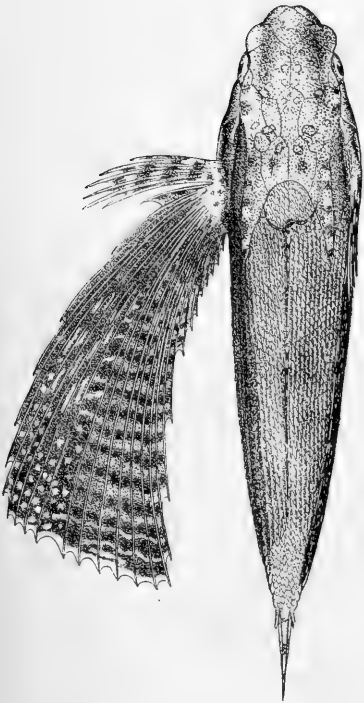
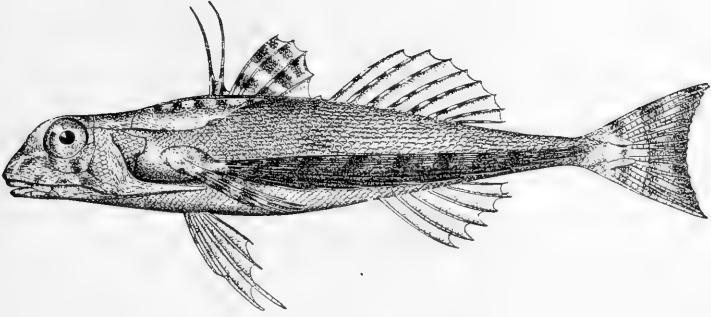
Gonocephalus is a name given in a manuscript finished by Gronovius about 1780, but unpublished till 1854.

The only figures illustrative of the osteology of *Dactylopterus* I have seen are the following:

DACTYLOPTERUS VOLITANS.

Dactylopterus volitans Sorensen, Lydorganer has Fiske (Naturhist. Tijdskr., 1884), pp. 75-78, pl. 3, fig. 37-42, 1884.

* Seven new specific names are given by Swainson to what are, in most cases at least, formerly described species, owing to various misapprehensions.



DACTYLOPTERUS VOLITANS.

NOTES ON THE BIRDS OBSERVED DURING THE CRUISE OF THE
UNITED STATES FISH COMMISSION SCHOONER GRAMPUS IN
THE SUMMER OF 1887.

BY
WILLIAM PALMER,
Taxidermist U. S. National Museum.

At the request of Professor Baird, I accompanied the U. S. Fish Commission schooner *Grampus* on her summer cruise in 1887 for the purpose of observing and collecting the fish-eating birds, together with their eggs and young.

In the following pages I have treated each species briefly, giving only the results of our own observations. As all on board were interested in the matter, and frequently called my attention to birds seen by them, I believe the list contains all the species that came within a reasonable distance of the vessel.

One might naturally think that on a cruise of this character sea-birds would be found to be generally numerous, but such was not the case. With few exceptions, and these mainly on breeding islands, birds were very scarce, most of the many species having completed their migrations, and being in the far north or inland.

As to the relative abundance of the species, I would place the most prominent in the following order: Puffins, Shearwaters, Black Haggons, Murres, and Gannets. Good skins were made of the greater number of the species, and in many cases, also, eggs, embryos, and young in various degrees of plumage, were obtained.

The localities visited were as follows: The Magdalen Islands and Bird Rocks, in the Gulf of St. Lawrence; St. John's; Funk Island; Seldom Come By; Cape Freels Penguin Islands; Toulinguet and Canada Bay, in Newfoundland; Black Bay and Mingan Islands; southern Labrador, and Percé, Canada.

The time covered was from July 8 to August 31.

A.—AQUATIC BIRDS.

1. *Urinator imber* (Gunn.). Loon.

One seen in Canada Bay, and several others near the Mingan Islands, were the only ones met with.

2. *Fratercula arctica* (Linn.). Puffin.

I should consider this bird (excepting, perhaps, the hagdons), to be the commonest seen on the cruise. At the Bird Rocks and Bonaventure Island they were outnumbered by the gannets, but at the other places visited they were far in the majority. Standing on Funk Island, during the day, one would think that the screaming, quickly moving Arctic terns were the most abundant, but as evening approaches an apparently endless stream of puffins, coming from all points of the compass for miles around, flock to their breeding grounds in the center of the island, most of them having fish in their bills for the young. Flying in a straight line they would suddenly notice the observer, and, swerving to the right or left, perch in immense numbers upon the bowlders and high broken rocks. After a short rest many would fly off and disappear in the numerous breeding holes which have been excavated by them under the weather-worn and broken rock characteristic of the island. A few fresh eggs were found; but most of the burrows examined contained young birds only a few days old. At Mingan a few young were flying about, while at Bonaventure they were quite numerous.

At the Mingan Group these birds breed only on an islet near Mingan or Bald Island, and on the little group of islets to the westward called Perroquet Islands. Here they excavate burrows on the surface, mostly connected by runs from the edges of the cliffs, their excrement and offal causing an immense growth of vegetation, principally the *Cælopleurum gmelini*, to completely cover the surface to a height of about ten feet.

From the number of wings seen near an Indian lodge at Mingan it would seem that they do not remain unmolested by man; but nature is slowly but surely confining their present breeding grounds, and in perhaps less than a century their nesting sites will be forever destroyed by the elements and the waters of the Gulf of St. Lawrence. It needs but a glance to show that these islands were very much larger than at present, and the most casual observer will notice that the same forces that reduced them to their present size are still at work. Such, indeed, would seem to be the fate in store for all the islands visited in the Gulf of St. Lawrence, their area being constantly reduced and there being abundant evidence that they at one time greatly exceeded their present size.

3. *Cepphus grylle* (Linn.). Black Guillemot.

The old birds were quite abundant at the Magdalen Islands during our stay, but no young were seen. A solitary bird at Funk Island, another in Canada Bay, and several small flocks near Cape Race were the only ones seen on the Newfoundland coast. At Mingan Islands and in Percé Harbor the full-fledged young were quite numerous, together with a few old birds moulting their summer plumage, and

consequently unable to fly. The stomachs examined contained remains of fish, crustacea, stones and small shell-fish. In one case, that of a young bird of the year at Mingan, all these were found.

4. *Uria troile* (Linn.). Murre.

Still very numerous at the Bird Rocks, but much less so at other places visited. The bird is very much persecuted by fishermen, both for its eggs and flesh. At the time of our visit to the smallest Bird Rock we found three fishermen in possession, who, with an ancient shotgun, had obtained quite a pile of the breeding birds, together with a few razorbills, which were destined to vary the monotony of a fish and salt-meat diet. Continual persecution has the effect of causing the murre to lay their eggs in the most inaccessible places, and it was only with difficulty that a few eggs and young were obtained.

I will here call attention to the manner in which these birds are mounted for our museums, and indeed, also to the pictures of this and allied species. But few show any approach whatever to the natural attitude. There is entirely too much of the robin or crow about them and too little of the distinctly specific and characteristic attitude of diving birds. The commonest mistake seems to be mounting the bird sitting on its tail, nine-tenths of mounted birds and illustrations showing this fault. As a matter of fact, the birds rest entirely on the tarsus, even walking in this position; but when hurried raise up on their toes and move very quickly. When resting or walking on the tarsus the tail is elevated above the ground so that one may almost pass the open hand between; the thighs are very full and pronounced, and the feet trend inwards. Another fault is in making the neck and breast entirely too large. In the many specimens I examined the upper part of the breastbone showed very prominently, and the head and neck were very small. This bird feeds almost exclusively on fish, especially such species as the lant and capelin, which they capture under water, using their wings to propel themselves. We had a good opportunity of witnessing this, having captured a murre alive and placed it in the well of the *Grampus*, where it proved of the greatest interest to all.

At first it was very wild, but in a few days it would take food from our hands and follow one about. Upon dropping some food in the water it would instantly dive and quickly seize and swallow it, then swim around the well as if searching for an exit, and suddenly rise to the surface. Its motions under water were very rapid and the movements of the wings similar to those of flight, except that the wings were never outstretched, the muscular effort being confined to the humerus and ulna. I brought the bird to Washington, where it lived for several weeks in the basin in the rotunda of the National Museum and attracted considerable attention by its odd and peculiar ways.

5. *Uria ringvia* Brünn. Ringed Murre.

I took a single specimen of this doubtful species at the Bird Rocks. Upon comparison with the other murre taken the same day, I noticed that it differed not only in having the white feathers around the eye, but also in its feet, which were much smaller and less strongly colored. At the time, I wrote in my note-book that the "*ringvia* differs from the common murre in having a white ring around the eye and a white line extending from it backwards; also in having smaller feet with a very faint tinge of color on the scales of the toes between the joints, which is very strongly marked in the common murre and *U. lomvia*."

6. *Uria lomvia* (Linn.). Brunnich's Murre.

Very abundant at the larger Bird Rock. A young bird taken while approaching Canada Bay was the only one of this species seen elsewhere.

7. *Alca torda* Linn. Razor-billed Auk.

Most abundant at the Bird Rocks. At Funk Island they were far from common, and, with the murre, laid their eggs in crevices and under rocks that were only accessible with much trouble and difficulty.

It is easy to imagine what must have been the abundance of these birds in former years on this lonely, almost inaccessible ocean island. Great auks, murre, razor-bills, puffins, Arctic terns, gannets, and perhaps other species undoubtedly swarmed, each species having its own nesting ground, and never molested except by an occasional visit from the now extinct Newfoundland red man; but now, since the white fisherman began to plunder this, to them, food and feather giving rock, how changed: To-day, but for the Arctic terns (which are useless for food or feathers) and the puffins (which are in most cases impossible to dig out), the island may be said to be deserted by birds. Only bones of the great auk, a few murre, still fewer razor-bills, and a few birds of other species are all that now breed on the island. Sixteen barrels of murre and razor-bill eggs have been known to be gathered at one time, and taken to St. John's. On July 23 and 24, aside from those of the Arctic tern, we did not see a dozen eggs.

8. *Plautus impennis* (Linn). Great Auk.

This bird can hardly be left out, especially as its remains was one of the objects and a skin one of the hopes of the cruise. The bird is almost beyond doubt extinct. At Twillingate we heard of a man who had said he had seen a bird within two years past, but as he was away at the Labrador, fishing, and nothing definite could be learned of the locality, it was not deemed advisable to waste time in following what was probably a mistaken identification. The fate of the great auk is

well known among the people of eastern Newfoundland, and with the constantly increasing travel and the high value of the skin or eggs, it would seem strange that, if the bird still exists, none should have been taken for so many years.

9. *Stercorarius pomarinus* (Temm.). Pomarine Jaeger.

Several were seen at intervals from Cape Pine northwards, and through the strait of Belle Isle to the Mingan Islands, but they were very shy and none were obtained.

10. *Rissa tridactyla* (Linn.). Kittiwake.

Breeding abundantly at Bird Rocks, Bonaventure and Bacalhao Islands, Newfoundland. None were seen elsewhere except on the homeward voyage, off Cape Sable, when several young were observed. A young bird taken from the nest at Bird Rocks was kept alive and accompanied us around Newfoundland, becoming, as it grew up, quite a pet with all on board, and being allowed perfect freedom. On the homeward voyage, when off East Point, Prince Edward Island, a mackerel schooner sailing in an opposite direction came close by to speak with us. The bird was on deck at the time, and as the vessel passed the wind from the sails of the mackerelman swept down on our decks: Johnny felt it and opening his wings flew from the vessel to some distance. He, however, returned, but the *Grampus* was going at such a rate that he could not reach her; he then flew off but soon returned and tried again to make the vessel but failed. Again he flew off and making a wide detour returned and again attempted to reach the vessel, but the rapid rate at which we were going prevented him, and at last, tired out, he slowly settled on the surface, carefully dropping his feet as he reached the water, precisely in the same manner as older birds. Considering that the bird had never flown before, and since he was a nestling had never seen other birds flying, his performance, especially his three attempts to reach the vessel, was remarkable. He had become a pet with all on board, and it was with great regret that we were compelled to leave him to his fate; a victim, doubtless, to his inability while in captivity to make proper use of the oil glands which in sea birds are a very essential part of their economy.

11. *Larus marinus* Linn. Great Black-backed Gull.

Quite frequently seen in the Gulf of St. Lawrence, and on the Newfoundland coast, but everywhere shy and keeping well out of range. A few young were flying about the Mingan Islands, but they were very shy.

12. *Larus argentatus smithsonianus* Coues. American Herring Gull.

Very abundant along the Newfoundland and Labrador coasts where they breed about the shores of the numerous lakes and ponds which

occur so frequently in this region. At Fogo Island we were told that the nests were placed upon the lower branches of the spruce trees on the islets in the lakes; but at Mingan Islands, where the birds were very abundant, and but little disturbed, numerous nests were found on the ground under trees and near the edges of ponds.

Some of the nests were simply depressions in the top of hillocks of moss; others were evidently similar depressions on patches of dead grass and other plants, but in most cases the birds had drawn some of the dried grass and even sticks around them as they sat on the eggs. At the time of our visit the young had all left the nests, but a few were found concealed among the rocks and bushes, although most of the young of the season were flying overhead. On one of the Mingan Islands, which is heavily wooded, hundreds of the gulls might be seen in the evening roosting on the tall evergreen trees, but on another island, which is entirely destitute of trees, the birds roost in immense numbers on the high ground, keeping up all night a continual babel of sounds which can be heard several miles.

The well-fattened young of this species may be said to form a not insignificant part of the winter diet of the Newfoundland fisherman at outlying places. Capt. J. W. Collins in an interesting paper on sea-birds, in the report of the U. S. Fish Commission for 1882, alludes to this habit of the coast fisherman as follows :

It may be of interest to mention in this connection that the coast fishermen of Newfoundland capture the young of the sea-gulls (generally of the larger species) while they are yet nestlings, and carefully rear them until they are full grown, feeding them chiefly on fish. A single family may have a dozen or twenty of these young birds. I have frequently seen ten or a dozen young gulls in a pen at Belloram, Fortune Bay, and there were a number of such pens in the little village. In many places on the Newfoundland coast these birds, I have been told, occupy the same place that with us is filled by the domestic fowls. Instead of the conventional turkey for the holidays, the coast fisherman is satisfied with the young and fat gulls which he has raised.

I have been unable to find any other published account of the utilization of the young of this species as food. While the *Grampus* was at Little-Seldom-Come-By Harbor, Fogo Island, I had an opportunity of examining a pen of these birds, which are kept in the same manner as one keeps pigs. The birds, of which there were eight of different sizes, belonged to an apparently prosperous fisherman. A corner of the garden had been converted into a pen about 5 feet square. Wishing to obtain a specimen of the young, I made known to the good housewife my reasons for desiring one, but she simply could not understand that I wanted it as a specimen, so the husband was called in and the matter explained. After considerable talk and explanation, and the promise on my part that if they would visit the vessel I would be only too glad to recompense them with some powder and shot, I succeeded in obtaining their consent to select a specimen. I doubt if to this day they have been able to comprehend my reasons for desiring the specimen.

The birds are fed mostly on fish offal; in fact, nothing comes amiss to them, their ability to swallow being only limited by their size and the extent to which they can expand their jaws. As a consequence, they become very fat and tame, following one about like a dog, and occasionally going to the water and helping themselves to what they can find, but invariably returning to their homes. In January and February, when other food is scarce, the gulls are killed and return to the sometimes famished fishermen and their families, in another and more palatable form, some of that abundance which could not be otherwise utilized during the fishing season.

13. *Larus philadelphia* (Ord). Bonaparte's Gull.

Young flying birds were quite abundant at the mouth of Mingan River, together with a limited number of old birds. A few others were afterwards seen in the Straits of Canso.

14. *Sterna hirundo* Linn. Common Tern.

Met with abundantly everywhere, except on Funk Island.

15. *Sterna paradisæa* Brünn. Arctic Tern.

Breeding in immense numbers on Funk and Penguin Islands. None were seen elsewhere.

On Funk Island the eggs and young birds were very numerous, the nests occurring at intervals of a few feet throughout the central part of the island except where the space was occupied by the puffins.

The old birds were very numerous, screaming and hovering overhead, now and then swooping down and striking our hats with their wings. The young of the previous year were moderately abundant, but very shy, keeping well above the others, and only occasionally coming within shot; they were readily distinguished by the short tail and the peculiar appearance of the head.

The Arctic Tern is not at all choice about its nesting place. Seven specimens of the nests were collected which may be taken as typical of the different locations and are as different as the shape and coloration of the eggs.

Nest No. 1 is simply a few small broken pieces of granite and a bone of the Great Auk. The eggs were laid on the bare rock and the stones were arranged in a ring as if the bird had drawn them toward her as she sat on the eggs; although, as there were no stones within several yards of the nest, it would seem as if the bird had gathered them at a distance. Quite a number of these nests were seen.

Nest No. 2 is simply a depression scratched in gravel, and No. 3 is a similar depression in dry mussel shells.

Nest No. 4 is a depression in a bunch of plants of a species of plantain with several pieces of granite rock on one side. This nest was in a crevice.

In No. 5 the eggs were deposited in a living, tangled mass of chickweed about 6 inches high, the plants within a circle of 5 inches being dead, with the eggs in the center, thus forming the nest.

No. 6 contained three eggs and was really more nest-like than the others, being composed of dead grass, apparently well arranged, with a depression in which the eggs were deposited. This nest was taken on Penguin Island, and is composed of dead grass made into a hummock by mice (*Arvicola riparia*), which are very abundant on the island. The tern had simply appropriated the place, and scratching the top had soon formed the nest.

No. 7 is merely the top of a bunch of dry grass found along shore and adopted by the bird as a suitable nesting site.

Of the many nests examined two contained three eggs each; in one case two were incubated and the other perfectly fresh. Many nests contained a young bird and an egg nearly ready to hatch.

In no other species of bird with whose breeding habits I am familiar has nature been so prodigal of life as in the case of the young terns on Funk Island. The surface of the granite rock of the island has been corroded by time and the elements to such a degree that many shallow depressions have been rotted, as it were. These have been filled with water by the abundant rain, and prove veritable death-traps to the young terns. Many of them leave the nest when a few days old and wander about. Numbers are thus lost among the rocks and drowned while trying to get back to their parents. This explanation seems to me to account for the numbers of dead young found in the pools. In fact, I rescued a number in places from whence there was no escape for them except through several inches of water. There were two colors of the young, which had no relation whatever to the sex, and were about equal in abundance. In perhaps half of the instances both colors were found in the same nests, and not infrequently they were of different sizes.

16. *Puffinus major* Faber. Greater Shearwater; Hagdon.

Met with in immense numbers off the entire southeastern coast of Newfoundland, and less numerous on the northeast coast and through the Straits of Belle Isle, nearly to the Mingan Islands, also sparingly along the Nova Scotia coast while going north, and from Canso to Nantucket on our return. Between Cape Pines and St. John we saw thousands, nearly all of which were sitting on the water in flocks of from fifty to a hundred. In the Report of the Fish Commission for 1882, Capt. J. W. Collins, in a paper on the habits of this species, states that for a few days after their arrival at their destination in spring they congregate in flocks and remain for several days in apparent inactivity, without feeding. At such times they can not be enticed within range of a gun or baited hook. We tried in various ways to decoy them to the vessel, but without success; nor would they allow us to approach

near enough with a boat to shoot them, and it was only by sheer good luck that we were able to secure two specimens out of the many thousands seen.* The reason for their shyness and indifference to food when congregated in flocks in the spring and fall may lie in the fact that they are then moulting. The condition of the specimens obtained, together with the myriads of feathers floating on the surface of the ocean, would seem to prove this view. It is not an unusual event for the fishermen of Newfoundland to take this bird for food. When a fog has been blown on shore for several days, the hagdons become quite numerous in the bays and inlets along shore, and are then easily approached in a boat and shot.

17. *Puffinus stricklandi* Ridgway. Sooty Shearwater; Black Hagdon.

A few scattered individuals were seen when going north along the Nova Scotia coast, and from Cape Pines to St. John they were very numerous. The species was very common off Canada Bay and in the straits of Belle Isle, and a few were occasionally seen as far west as the Mingan Islands. On our return a few birds were seen soon after leaving Cape Sable, and then to within a few miles of Pollock Rip light-ship. Generally they were seen with the common hagdon, but on the Newfoundland coast it was not unusual to see them in large flocks by themselves. They were very wild, and we failed in every attempt to obtain a specimen. The day following our arrival in Canada Bay a dense fog set in, which was taken advantage of by some of the fishermen to secure a Sunday dinner of bird meat. The result of a few hours' shooting was about thirty birds, more than half of which were of this species, but unfortunately it was not known to us until the birds were all picked and most of them eaten.

18. *Oceanodroma leucorhoa* (Vieill.). Leach's Petrel.

Seen with varying degrees of abundance throughout the voyage. During our visit to the Bird Rocks four females and five eggs were taken from a hole which had its opening at the side of a slight depression. The birds were clustered together, and a little short dry grass had been utilized as nesting material. The restricted area of the island and hardness and unsuitability of the surface may account for so many birds having nested in one burrow. The light-house keeper, who has resided on the island for about fifteen years and has given great attention to the birds nesting there, told me that he had only been aware of these birds nesting on the island since the summer of 1885 and had never yet seen a bird flying about the island during the day. At Penguin Island we found that this species had adopted old puffin and mice burrows as nesting places, and but a single bird and egg were found

* Capelin were very abundant at the time, and perhaps the abundance of food prevented them from taking our bait.

in each. During the few hours we spent there I noticed a petrel continually flying backwards and forwards across the island in the same manner as a swallow. The bird was evidently seeking its nest, but was disturbed by our presence, and after several attempts on my part to get within range it flew out to sea.

19. *Oceanites oceanicus* (Kuhl.). Wilson's Petrel.

Met with only at Cape Sable and Cape Cod, when homeward bound. In proportion to the preceding species they were about as one to a hundred. Several specimens were obtained by decoying both species to the vessel by small pieces of fat, but all attempts to take one on a hook were futile. The yellow spots on the web of the feet readily distinguished this species whenever they approached the water to take the fat, both species having the habit of dropping the legs and expanding the toes when taking food.

20. *Sula bassana* (Linn.). Gannet.

The gannet is the best known and the most striking of all the birds seen on the cruise. To the fishermen they are especially interesting, as their presence informs them of the approach of the schools of herring and mackerel, and hence they are eagerly watched. Their eggs are always welcome, and every nest that by any means can be reached by man is repeatedly robbed of its contents. On our visit to the little Bird Rock we found the surface of the larger rock covered with newly made nests, but not an egg was to be seen, the nests having doubtless been repeatedly robbed, as the surface of the rock could be reached with comparatively little difficulty.

The top and sides of the pillar, or smaller rock, were literally covered with the breeding birds, but it was only by the greatest difficulty in climbing and the use of a net that a few eggs and young birds were collected. But three breeding places of the species were found by us, and so far as I can obtain information no others exist on our coast except on eastern Labrador.

Mr. Lucas has so thoroughly written up this species in "The Auk" for April, 1888, to which the reader is referred, that I have very little to add. That the abundance of the species in the Gulf of St. Lawrence has greatly diminished within the past few years is self-evident. A very superficial examination will convince any one that not only is the bird persecuted by man, who robs it of its eggs whenever he can reach its nests, but that even nature is its enemy, and will eventually force it from its present breeding grounds and compel it to move elsewhere or succumb to the fate that has overtaken so many now extinct species that have duly run their race.

Time, frost, and moisture will at some time in the future level the present nesting sites of the gannet beneath the waters of the Gulf of St. Lawrence, and the perpetuation of the species will depend on the adaptability of the bird to other and perhaps new conditions.

21. *Phalacrocorax dilophus* (Sw. and Rich.). Double-crested Cormorant.

A few seen off Mingan, but at Perce they were very abundant.

2. *Merganser americanus* (Cass). American Merganser.

One seen at Mingan.

23. *Anas obscura* (Gmel.). Black Duck.

In Canada and Black Bays but few were seen, but they were quite abundant at Mingan.

24. *Somateria dresseri* Sharpe. American Eider.

At the Mingan Islands several large flocks of the young of this species were met with. Accompanied by the old birds they would coast the shores, but when approached in a boat would swim rapidly out to sea, and when overtaken, being unable to fly, would dive and scatter most effectually.

25. *Oidemia deglandi* Bonap. White-winged Scoter.

Several flocks were seen at the Mingan and Magdalen Islands.

26. *Branta canadensis* (Linn.). Canada Goose.

A small flock was seen flying southward on August 11, at Mingan.

27. *Ardea herodias* Linn. Great Blue Heron.

The only herons seen on the cruise were two birds of this species, which perched upon the edge of Perce Rock, 270 feet high, looked down on us apparently conscious that they were safe from our guns.

28. *Crymophilus fulicarius* (Linn.). Red Phalarope.

Met with in great abundance between Cape Sable and Cape Cod on August 30, usually feeding among the drift sea-weeds in the calm water between the tide-rips. A small flock was also seen off Bonaventure Island on August 23.

The abundance of this species off Cape Sable at this time would probable indicate their line of fall migration. The trend of the coast and the abundance of food in the tide-rips caused by the tides of the Bay of Fundy would furnish abundant reason why this graceful little bird should brave the sea at such a distance from land. These birds are known to the fishermen as sea-geese, a not inappropriate name, one would think while watching them paddling rapidly up the side of a huge wave and gracefully flying over its crest just as the waters seemed to engulf them. The dense mass of feathers on its breast seems to fit it entirely for an ocean life, and one doubts while viewing it among the waves, as it rapidly and gracefully paddles among the sea-weeds seeking its food, that there is anything snipe-like in its structure.

29. *Phalaropus lobatus* Linn. Northern Phalarope.

While approaching the Mingan Islands, on August 10, several large flocks of this pretty little bird were seen feeding in the long streaks of calm water between the tide-rips.

30. *Gallinago delicata* (Ord.). Wilson's Snipe.

Quite abundant near St. John's, where they were seen by the roadside.

31. *Micropalama himantopus* (Bonap). Stilt Sandpiper.

One seen at Penguin Island.

32. *Tringa canutus* (Linn.). Knot.

Two females were taken on Mingan Island from among the flocks of the following species.

33. *Tringa fuscicollis* Vieill. White-rumped Sandpiper.

The commonest bird at the Mingan Islands, far outnumbering all other species together. A few flocks were found in Canada and Black Bays. As it is the habit of this bird to congregate in dense flocks, so that from fifty to one hundred can be killed at one discharge, it is consequently sought after by the Indians and fishermen.

35. *Calidris arenaria* (Linn.). Sanderling.

A few in Canada Bay in company with the white rumped sandpipers.

35½. *Totanus melanoleucus* (Gmel.). Greater Yellow-legs.

Very abundant at Mingan, but not seen elsewhere.

36. *Actitis macularia* (Linn.). Spotted Sandpiper.

Seen sparingly at every place visited.

37. *Numenius* sp. (?) Curlew.

A few flocks seen at Black Bay and the Mingan Islands were the first arrivals. These birds feed mostly on berries, which are very abundant on the hills, becoming very fat, and are easily obtained before their departure.

38. *Ægialitis semipalmata* Bonap. Semipalmated Plover.

A few were taken at Mingan.

39. *Ægialitis meloda* (Ord.). Piping Plover.

Common on Amherst Island, Magdalens; a small flock was seen near St. John's.

40. *Arenaria interpres* (Linn.). Turnstone.

A few found at Mingan with other shore birds and evidently migrating; they were very shy and watchful.

B.—LAND BIRDS.

In addition to the sea birds, such opportunities as were incidentally afforded were improved to observe and collect land birds, many of which were interesting, while one species had not previously been obtained for the collections of the National Museum.

The following is a list of those seen and collected :

Dendragapus canadensis (Linn.). Canada Grouse.

Several young birds of this species were seen by some of the party on two occasions in the spruce at the mouth of the Mingan River. They were very tame and permitted one to approach within a few feet. We were informed that they were generally very abundant, but that great numbers had been destroyed by the severity of the previous winter.

Lagopus welchi (Brewst.). Welch's Ptarmigan.

Called Rock Partridge by the natives of Canada Bay, but this name would seem to be applied to other species of the genus. The Willow Ptarmigan, which is the common species, is readily distinguished by Newfoundlanders from the other species, and is always found on much lower ground. Two birds, a pair, were collected on the high rocks near the Cloud Hills in Canada Bay, at an elevation of a thousand feet. Here the bird breeds and is abundant, according to the account given us by the fishermen.

Buteo borealis (Gmel.). Red-tailed Hawk.

Two were seen at the Mingan Islands.

Buteo lineatus (Gmel.). Red-shouldered Hawk.

While passing through the Straits of Canso on our return, a bird of this species made several ineffectual attempts to perch upon the truck of the main-topmast.

Falco columbarius (Linn.). Pigeon Hawk.

Very abundant at the Mingan Islands, but not seen elsewhere; though a small hawk seen at Black Bay may have been of this species. Their abundance may have been owing to the presence of numerous flocks of white-rumped sandpipers and other shore birds, upon which they to a great extent subsist. While lying at anchor in Mingan Harbor, we witnessed the efforts of a hawk to capture a sandpiper. For fully five minutes the sandpiper tried by sudden twistings and turnings to evade

the claws and beak of its enemy, and for a time proved by its maneuvers to be more than a match for the hawk. But at last, completely exhausted, it fell a prey only to the superior endurance of its captor.

Pandion haliaetus carolinensis (Gmel.). American Osprey.

But few seen; one off Cape Race, Newfoundland, eight miles from land. Several pairs at the Mingan River, and several in George's Bay, off Cape Breton Island.

Ceryle alcyon (Linn.). Belted Kingfisher.

Quite common at the Magdalen Islands; only seen elsewhere at the mouth of the Mingan River.

Colaptes auratus (Linn.). Flicker.

A single bird of this species seen near St. John's was the only woodpecker met with.

Empidonax flaviventris (Baird). Yellow-bellied Flycatcher.

Two specimens were collected near St. John's, July 19th, in clearings in the woods where evidently they were breeding. No other flycatchers were found, though diligently looked for.

Otocoris alpestris (Linn.). Horned Lark.

Found only at Penguin Islands and Canada Bay. At the former place (a low, flat, grassy island) several old birds were seen, who, during our visit, perched on the bowlders that surround the island, and two young birds, which were evidently bred at the island, were collected. At Canada Bay a few old birds were found at the Cloud Hills, at an elevation of nearly 1,000 feet.

Corvus corax nobilis (Ridgw.). Northern Raven.

By no means abundant; quite a number were seen in Canada and Black bays and flying on the Straits of Canso, generally in flocks of five or six. At the former places they would visit the shore at low tide to feed upon the dead and dying capelin, which were left in abundance on the beaches. Every attempt to get near the wary birds proved futile, but at Black Bay one at least owed its safety only to the exasperating abundance of that intolerable nuisance, the black fly.

Corvus americanus (Aud.). American Crow.

Common at the Magdalen and Mingan Islands; several were also seen near St. John's. At Mingan we were told that ravens were abundant there; none were seen, though crows were quite common; evidently no distinction is made, and to the natives they are all ravens.

Perisoreus canadensis nigricapillus (Ridgw.). Labrador Jay.

At Fogo Island, Canada Bay, and Mingan Islands, in wooded places, a few jays were found, though never abundant.

The birds were all found near the edge of the dense spruce woods, and were evidently attracted to us by the noise made by forcing our way through the underbrush; in fact every bird collected, when first seen, would fly directly towards us and perch upon the nearest tree. At Canada Bay, while walking along a gravelly beach, necessarily making considerable noise, a jay flew out of the dense wood at the side of a hill, and perched upon the top of the nearest tree. I stood motionless while he eyed me for some time. Apparently not satisfied, he flew nearer, to a dead branch, and repeated his scrutiny; still not satisfied, he next perched upon a dead branch lying upon the beach not 10 feet in front of where I stood, and sat turning his head now on the one side and then on the other, so as to get a good observation of what was apparently to him a great novelty.

On a subsequent occasion, after spending the day on one of the Mingan Islands, which is very densely wooded, we started to drag our dory down to the water, necessarily making considerable noise. While doing so, and glancing towards the wood, I observed a jay perched upon the top of the nearest tree, evidently interested in our proceedings. I immediately shot him, and the report had hardly died away when another jay took his place. He, too, followed the first, when instantly another flew to the very same tree, only, however, to meet the same fate.

Though we had spent the whole day on the island, and I had walked entirely around it, we had not seen a jay until the unusual sound caused by dragging the dory over the gravelly beach had apparently attracted their attention.

Scolecophagus carolinensis (Müll.). Rusty Black-bird.

One seen at the Magdalen, another near St. John's, and several small flocks on Fogo Islands.

Quiscalus quiscula æneus Ridgw. Bronzed Grackle.

Several crow black-birds were seen near St. John's, on July 19. As *Quiscalus quiscula* is not known to occur north of New England, I refer the Newfoundland bird to this subspecies.

Loxia leucoptera Gmel. White-winged Cross-bill.

Observed only at the Magdalen Islands, where it was very abundant. At the Larger Bird Rock, on July 9, they were quite numerous, in company with pine siskins, hopping on the ground like sparrows, and apparently feeding on the short grass. They were very tame, allowing one to approach within a few feet.

Acanthis linaria (Linn.). Redpoll.

A flock of nine birds were found on Funk Island feeding upon the short grass, and when disturbed, seeking shelter under the large boulders and overhanging rocks. A number were also seen at Twillingate and Canada Bay in the vicinity of houses.

Spinus pinus (Wils.). Pine Siskin.

Very abundant at the Magdalen Islands and in Newfoundland. Several came aboard on rainy occasions when several miles from land; at St. John's they were very abundant, usually in flocks about the roadside and fences.

Ammodramus sandwichensis savanna (Wils.). Savanna Sparrow.

Very abundant at all places visited. This bird would seem to take the place in the Magdalen Islands and Newfoundland of all the small sparrows so common in the States. In the fields and waste places and about the houses one could always find this interesting species. Almost the only bird song heard on the voyage were the exquisite trilling notes of this species; perched upon a roadside fence or top of a solitary bush, they would burst forth with their peculiar song, and the next moment dart headlong into the nearest bunch of long grass, rapidly making their way for some distance and then peering out or hopping to the center of a little elevation and looking back to see what caused the alarm.

Zonotrichia leucophrys (Forst.). White-crowned Sparrow.

Only seen at Black Bay, Labrador, where they were quite abundant.

Zonotrichia albicollis (Gmel.). White-throated Sparrow.

Common everywhere, generally about bushy places, and especially about gardens, where they were complained of as a nuisance, scratching out potatoes, etc.

Spizella monticola (Gmel.). Tree Sparrow.

Seen only at the Cloud Hills, Canada Bay, among the hills, in bushy places and ravines, at an elevation of a thousand feet.

Junco hyemalis Linn. Snow Bird.

A few at the Magdalens and but one at Mingan.

Melospiza georgiana (Lath.). Swamp Sparrow.

Several found near St. John's, about thick bushes, in marshy places.

Passerella iliaca (Merr.). Fox Sparrow.

A very abundant bird at most places visited, generally on low ground, and usually about gardens, where several might be seen at any time scratching for worms, etc.

Tachycineta bicolor (Vieill.). Tree Swallow.

Seen at the Magdalen and Mingan Islands, though not abundant. No swallows were seen while in Newfoundland waters.

Dendroica æstiva (Gmel.). Yellow Warbler.

Seen near St. John's, where it is well known.

Dendroica coronata (Linn.). Myrtle Warbler.

A pair were taken in a wood near St. John's.

Dendroica striata (Foist.). Black-poll Warbler.

Very common at the Magdalens, St. John's, Canada Bay, and Black Bay, where the familiar call was as tantalizing as in more southern climes.

Dendroica virens (Gmel.). Black-throated Green Warbler.

Two birds were taken at the Mingan Islands.

Seiurus noveboracensis (Gmel.). Water Thrush.

Common near St. John's and on Fogo Island, in the underbrush on the shores of the small lakes. Two young, nearly grown, were taken near St. John's on July 19.

Sylvania pusilla (Wils.). Wilson's Warbler.

Two specimens were taken in Newfoundland.

Setophaga ruticilla (Linn.). Redstart.

Common in the woods near St. John.

Anthus pennsylvanicus (Lath.). American Pipit.

Three specimens, an old bird and two full grown young, were taken on the rocks at the Cloud Hills, in Canada Bay, at an elevation of a thousand feet.

Sitta canadensis Linn. Red-bellied Nuthatch.

I captured a young bird with a dip-net, on board, when about 12 miles south of Natashquan Point, Labrador, on August 9.

Parus atricapillus Linn. Chickadee.

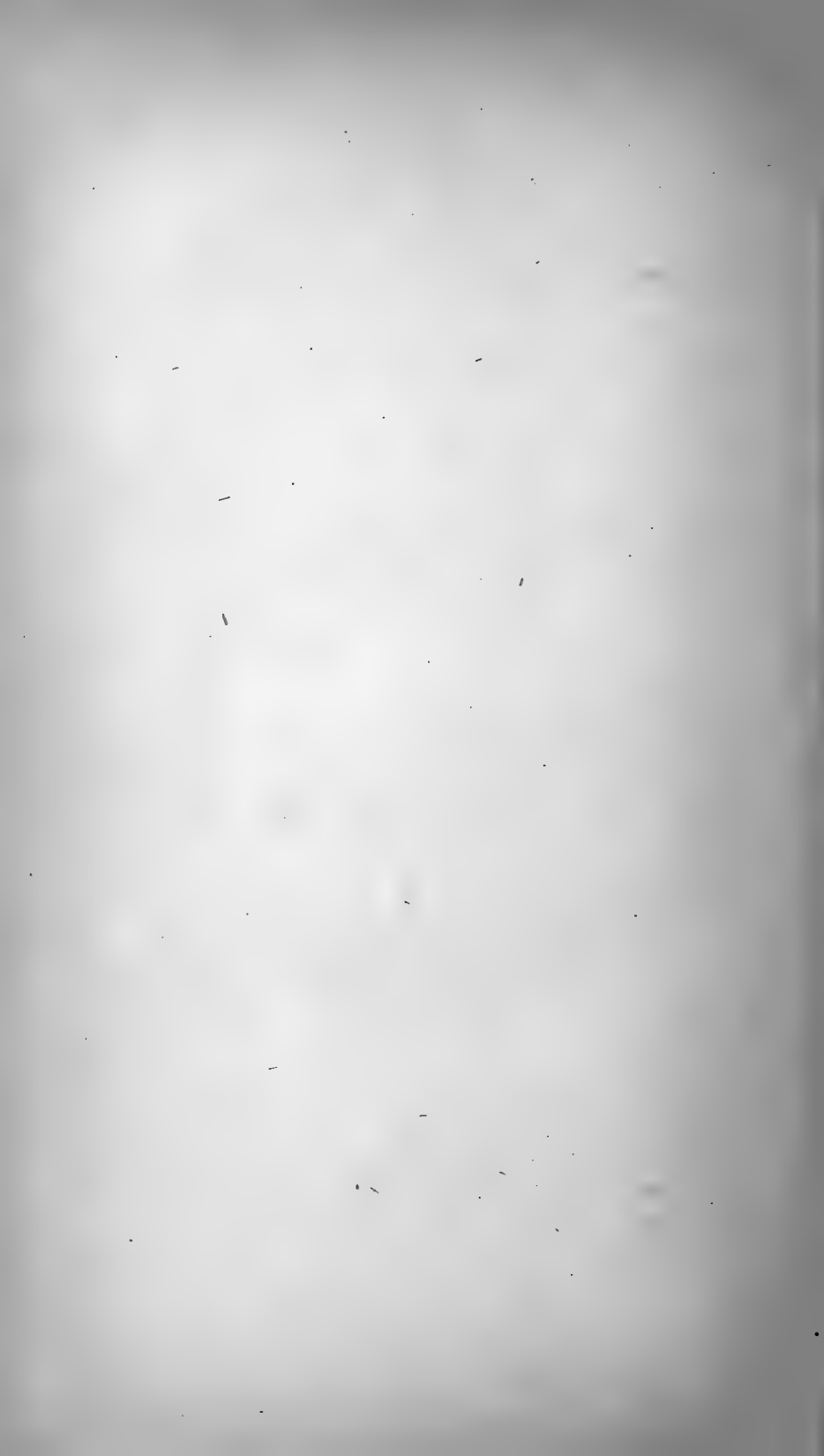
Common near St. John's, but not seen elsewhere.

Turdus aliciaë Baird. Red-cheeked Thrush.

A young bird, full grown, caught by a boy in a garden at Canada Bay, was the only one of the genus seen.

Merula migratoria (Linn.). American Robin.

Very abundant everywhere.



DESCRIPTION OF NEW FORMS OF UPPER CAMBRIAN FOSSILS.

BY

CHARLES D. WALCOTT,

Honorary Curator Department of Paleozoic Invertebrate Fossils.

(With Plates XX, XXI.)

In the course of a review of the Cambrian faunas it becomes necessary to designate a number of undescribed species by name in the lists from the various localities. They are from New York, Wisconsin, Minnesota, Texas, Nevada, and Dakota, and may all be referred to the Upper Cambrian fauna. In New York and Texas two subfaunas exist, in Wisconsin three, and in Nevada two, and possibly three.

Metoptoma ? minneiskensis sp. nov.

Plate XX, Fig. 2.

Shell conical, broadly elliptical in outline, apex pointed, subcentral, surface marked by broad undulations of growth in some specimens, while in others it is nearly smooth. Peristome broadly sinuate in front and back, in the narrow specimens, and usually so on the anterior side in all. Outer surface of shell unknown.

This species is one of the numerous conical, paterelloid shells that are referred to the genus *Metoptoma* while awaiting more definite information as to their true generic relations. Mr. W. A. Finkelnburg sent a number of specimens and Dr. Cooper Curtice collected a few.

Formation and locality.—Upper Cambrian Sandstone (Middle horizon) Minneiska, Minnesota.

Nat. Mus. Cat., Invert. Foss., 23844.

Metoptoma ? peracuta sp. nov.

Plate XX, Fig. 1.

Shell very elongate, conical, rounded, elliptical to circular in outline at the aperture. Surface marked by more or less distinct undulations of growth. Apex subcentral. Outer surface unknown.

This species occurs at the same horizon as *M. ? minneiskensis* in a friable sandstone. It differs in being much more elongate and the less excentric position of the apex.

Formation and locality.—Upper Cambrian Sandstone (Middle horizon) at Spofford's Bluff, Wisconsin. Collector, Dr. Cooper Curtice.

Nat. Mus. Cat., Invert. Foss., 23843.

Platyceras hoyti sp. nov.

Plate xx, Fig. 8.

Shell small, depressed, making about three volutions, the interior below the plane of the outer volution. Volutions contiguous throughout their extent, expanding gradually to the somewhat compressed, more rapidly expanding outer whorl. Aperture unknown.

Outer surface of shell marked by fine concentric striae and the inner surface by longitudinal striae.

This species differs from the associated *P. minutissimum* in the form of the whorls and surface characters. The longest specimen has a transverse diameter of 4^{mm}.

Formation and locality.—Upper Cambrian limestone, 4 miles west of Saratoga Springs, New York. C. D. W., collector.

Nat. Mus. Cat., Invert. Foss., 23846.

Platyceras texanum sp. nov.

Plate xx, Fig. 5.

Capulus sp.? Shumard, 1861, Am. Jour. Sci., 2d ser., vol. 32, p. 221.

Shell small, making about two (?) volutions, the interior below the plane of the outer volution but not quite on the median line. Volutions apparently contiguous throughout their extent, the inner, or spire, small, gradually expanding; body volution strongly carinate upon the dorsum, and expanding gradually to the large subelliptical outer portion. Aperture unknown.

This species is more nearly related to *P. minutissimum* of the Potsdam of New York than to *P. hoyti*. The longer specimens have a diameter of 7^{mm} across the body whorl.

Formation and locality.—Upper Cambrian Limestone, of Packsaddle Mountain, Burnet County, Texas. Collector, C. D. W.

Nat. Mus. Cat., Invert. Foss., 23845.

Genus **TROCHUS** Linn.

Trochus? *saratogensis* sp. nov.

Plate xx, Fig. 3.

Shell trochiforme, sinistral, broadly conical with about four slightly convex whorls; base concave; umbilical surface sloping inward from the angle produced by its union with the outer curvature of the body whorl; umbilicus rounded and of medium size; aperture obliquely subelliptical; periphery unknown. Surface marked by a few fine striae of growth.

The shell occurs in association with *Dikellocephalus hartti*, *D. speciosus*, *Lingulepis acuminata*, etc., of the Upper Cambrian fauna. It is not a true Trochus, and in the photograph plate illustrating the Potsdam fauna of Saratoga County, New York, that I had prepared in 1885, it bears the name *Billingsia saratogensis*. This generic name was used in a list of species in 1886,* but no publication of the description of the species has yet appeared. The name *Billingsia* having been used the species is provisionally referred to *Trochus* until further comparisons can be made with *Eotrochus* and other genera of the Trochidæ.

Formation and locality.—Limestone of the Potsdam terrane, 4 miles west of Saratoga Springs, New York. Collector, C. D. W.

Nat. Mus. Cat., Invert. Foss., 23847.

Hyalolithes attenuatus sp. nov.

Plate XX, Figs. 11, 11a.

Form an extremely elongate triangular pyramid. Transverse section subtriangular, width and depth as three to two. The dorsal side nearly flat, with the exception of a shallow, narrow, median groove. Ventral face convex, with the ventral angle broadly rounded. Surface apparently smooth.

In its rounded ventral side this species resembles *H. princeps* of the Lower Cambrian.

Formation and locality.—Upper Cambrian limestone of the Highland Range section, central Nevada. Collector, C. D. W.

Nat. Mus. Cat. Invert. Foss., 23850.

Hyalolithes curvatus sp. nov.

Plate XX, Figs. 7, 7a.

Shell, an elongate curved pyramid that becomes attenuated towards the apex. Transverse section triangular, with the width and height subequal. Ventral face very convex, strongly angular at the center, sides slightly rounding. Dorsal face slightly convex or nearly flat at the margin and rising towards the center. Dorso-ventral angles sharply and clearly defined. Anterior extension of the dorsal surface and form of aperture unknown. Shell apparently thick. Surface of the shell marked by strong concentric lines of growth near the aperture, and longitudinal lines that separate fine, rounded ridges, not much wider than the depressions between them. These are not shown in the figure.

The tendency to curvature is shown in several species illustrated by M. Barrande, but none is so marked as in the species under consideration.

* Bull. U. S. Geol. Surv., No. 30, 1886, p. 21.

Formation and locality.—Associated with the preceding species. Collector, C. D. W.

Nat. Mus. Cat. Invert. Foss., 23851.

***Hyolithes ? corrugatus* sp. nov.**

Plate XX, Fig. 9.

Shell, an elongate, gradually and regularly tapering, obscurely subtriangular cone. Transverse section oval and somewhat flattened on one side, so as to give it a subtriangular form in some specimens. It is difficult to determine the dorsal and ventral faces in the absence of the aperture. Shell, strong; surface marked by prominent corrugations or undulations that are a little oblique to the longitudinal axis; they occur on the flattened sides and are not continuous across the narrow portion. There is also considerable variation in their depth and width, the interior casts usually showing the strongest undulations.

This shell does not appear to be a true *Hyolithes*. In many respects it is more closely related to *Coleoprion* or *Coleolus*, but varies in essential particulars. While awaiting further study a provisional reference is made to *Hyolithes*.

Formation and locality.—Associated with the two preceding species. Nat. Mus. Cat. Invert. Foss., 23852.

***Hyolithes newtoni* sp. nov.**

Plate XX, Fig. 4.

Form, an elongate, triangular pyramid. Transverse section subtriangular, slightly concave on the dorsal, and very convex on the ventral side. Dorsal face rounded on the margin and concave all across; anterior extension unknown. Ventral face highly convex and rounded along the median line. Aperture and operculum unknown. Shell apparently thick, but this is probably owing to the mode of preservation, as in a few specimens it is thin. Surface of shell as far as known marked only by a few concentric striae.

The concave dorsal surface taken in connection with the general outline serves to distinguish this species from others known to me.

Formation and locality.—Upper Cambrian, near Deadwood, Black Hills, Dakota. Collected under charge of Prof. F. R. Carpenter.

Nat. Mus. Cat. Invert. Foss., 23849.

***Conularia cambria* sp. nov.**

Plate XX, Fig. 10.

Form, an elongate pyramid, with a quadrangular ? base. Transverse section and aperture unknown, owing to the flattening of all the specimens. Angles of the pyramid marked by a very distinct groove. Faces of the pyramid slightly convex in the flattened specimens.

Surface marked by seven to nine longitudinal elevated lines on each face. If transverse striæ existed they have not been preserved on the cast or the matrix of any specimens in the collection.

The conditions of preservation are such that the original form can not be definitely determined, and the angle subtended by the sides of the pyramid is unknown. The apparently equal sides indicate a quadrangular section and a long, narrow pyramid. The specimen illustrated is the matrix of a crushed shell, showing the depressed line at the angle and the longitudinal lines of the faces. The longest specimen has a total length of 6^{cm} and a width of 16^{mm} on one face at the apertural end.

Formation and locality.—Middle beds of the Upper Cambrian (Potsdam) sandstone, Pilot Knob, Wisconsin. Collector, Dr. Cooper Curtice. Nat. Mus. Cat. Invert. Foss., 23848.

Spirodermalium gen. nov.

Shell tubular, curved, opened at both ends; attenuated posteriorly; aperture circular.

Surface spirally striated.

Type: *Spirodermalium osceola*.

This genus is founded to include a species that, with the exception of spiral striæ, might be referred to the recent genus *Dentalium*. The presence of spiral striæ, and the fact that it occurs so low down in the Paleozoic, are the principal reasons for distinguishing it from *Dentalium*.

Spirodermalium osceola sp. nov.

Plate xx, Fig. 12.

Shell elongate tubular, curved, longitudinally marked by several narrow grooves (two only are shown in the cast), open at both (?) ends, and gradually tapering towards the posterior end. Aperture, as far as known, circular and not constricted. Surface ornamented by spiral striæ that, from the portion of the surface preserved, passed around the tube three or four times in a length of 6 centimeters, the tube having a diameter of 7 millimeters at the aperture and 2.5 millimeters at the posterior end.

The specimen of this species now known occurs in a friable, brown sandstone as cast and the matrix. The drawing was made from a plaster cast taken in the matrix. The circular form of the tube is shown by the interior cast. Whether the posterior end terminates in an opening is not proven positively, but in the only specimen known it ends abruptly where the tube has a diameter of 2.5 millimeters. There is a slight trace of what may have been the tube, 1 centimeter further on, but this is uncertain.

The specific name is given from that of the old Indian chief Osceola. *Formation and locality*.—Upper portion of Cambrian (Potsdam terrane), Osceola Mills, Wisconsin. Collected by Dr. Cooper Curtice. Nat. Mus. Cat. Invert. Foss., 23853.

Ptychoparia burnetensis sp. nov.

Plate XXI, Fig. 1.

Head within the facial sutures subquadrangular, exclusive of the somewhat prolonged postero-lateral limbs.

Glabella convex, truncato-conical; exclusive of the occipital segment it is less than one-half the length of the head; glabellar furrows, if present, have been lost by the destruction of the outer surface of the test; occipital furrow strongly marked and extended as a deep groove across the postero-lateral limbs; occipital segment narrow and arching a little backward. Fixed cheeks narrow; palpebral lobes small; frontal lobe about one-sixth the length of the head and separated from the strong, somewhat elevated, frontal rim by a broad, rounded groove. The associated free cheek terminates in a short postero-lateral spine.

Formation and locality.—Upper Cambrian (Potsdam) Sandstone. "Tatur Hill," Burnet County, Texas. Collector, C. D. W.

Nat. Mus. Cat. Invert. Foss., 23854.

Ptychoparia connata sp. nov.

Plate xx, Fig. 2.

Of this species only the central portions of the head are now known. The glabella is truncato-conical, moderately convex, and marked by three pairs of slightly indented glabellar furrows. Occipital furrow narrow and arching forward at the center; occipital segment of medium width and slight convexity. Free cheeks, narrow; palpebral lobes about one third of the length of the head. Frontal limb narrow, and separated from the strong, rounded frontal rim by a broad shallow groove.

What we have of this species may be compared with *Ptychoparia oweni*, M. & H., *P. wisconsensis*, and *P. (C.) iowensis*, Hall. It differs in the strong frontal rim and groove in front of the glabella.

Formation and locality.—Upper Cambrian (Potsdam) sandstone, Eau Claire, Wis. Collector, Dr. Cooper Curtice.

Nat. Mus. Cat. Invert. Foss., 23855.

Ptychoparia llanoensis sp. nov.

Plate XXI, Figs. 3, 4, and 5.

Of this species there has been found the head, including the free cheeks, and the pygidium.

Glabella truncato-conical, the front broadly rounded; marked by three pairs of furrows that indent the surface from just within the mar-

gin obliquely backward about one-fourth the distance across. Occipital furrow, narrow and arching forward at the center; occipital segment of medium width, arching forward at the center where a small, sharp node occurs; dorsal furrows strongly defined all about the glabella.

Fixed cheeks narrow and merging posteriorly into the rather long postero-lateral limb, and anteriorly into the broad slightly convex frontal rim; palpebral lobes of medium size. The only division between the frontal limb and the nearly flat margin is a series of slight indentations; a similar line is also seen on the under side; in some specimens, however, this line of indentations is not shown and the frontal limb and rim merge together; in some others a slight transverse groove indicates the line of separation. The free cheeks are prolonged posteriorly into a long slender spine and have a faintly defined marginal rim.

The associated pygidium is transverse, convex, and strongly trilobed by the prominent, convex median lobe; marginal border narrow and nearly flat; median lobe divided by three transverse grooves into three annulations and a posterior more elongate termination; lateral lobes somewhat depressed and marked by three shallow furrows that extend from the median axis to the flattened margin.

Test rather thick over the frontal lobe and margin and strong on other parts. Surface apparently smooth or finely striate; this character is not well shown.

Of described species this is most nearly allied to *Ptychoparia eryon* Hall.*

Formation and locality.—Upper Cambrian limestone. Packsaddle Mountain, Llano County, Texas. Collector, C. D. W., 1884.

Nat. Mus. Cat. Invert. Foss., 23857.

Ptychoparia ? metra sp. nov.

Plate XXI, Figure 7.

Glabella conical strongly convex; occipital furrow, broad, shallow, and rounded; occipital segment of medium width and convexity; dorsal furrows deep on the sides and strongly defined in front of the glabella. Fixed cheeks only a line between the dorsal furrow and palpebral lobes; the latter are relatively large and grooved by a broad furrow parallel to the margin; anteriorly the fixed cheek widens out to form a small subtriangular area before reaching the frontal furrow; its posterior extension is unknown; frontal limb very short and descending down to the broad, concave frontal furrow that curves up to meet the short edge of the strong thick frontal margin. Surface a little rough in the cast; this may indicate a pustulose surface on the outer test.

This species is apparently congeneric with *P. urania* and the generic reference is provisional.

* Sixteenth Ann. Rep. State Cab. Nat. Hist., 1863, p. 157, pl. vii, figs. 10-16; pl. viii, figs. 16, 31.

Formation and locality.—Upper Cambrian (Potsdam Terrane). "Tatur Hill," Burnet County, Texas. Collector, C. D. W., 1884.

Nat. Mus. Cat. Invert. Foss., 23858.

***Ptychoparia pero* sp. nov.**

Plate XXI, Fig. 6.

The portion we have of this species is closely related to *P. explanata** Whitfield and *P. diademata*,† but differs in the conformation of the frontal limb, groove, and flattened margin. The specimens from Texas and Wisconsin appear to be identical as far as comparisons can be made between them.

Formation and locality.—Upper Cambrian (Potsdam Terrane). In a limestone on Morgan's Creek, Burnet County, Texas, and in a buff or brown sandstone, Trempealeau, Wisconsin. Collectors, in Texas, C. D. W.; in Wisconsin, Dr. Cooper Curtice.

Nat. Mus. Cat. Invert. Foss., 23859.

***Ptychoparia suada* sp. nov.**

Plate XXI, Fig. 9.

Glabella short, convex, truncato-conical; occipital furrow strongly defined; occipital ring convex, of medium width at the center and narrow at the sides; surface smooth; dorsal furrows deep on the sides and well marked in front of the glabella. Fixed cheeks narrow, convex, palpebral lobes relatively large and differentiated from the cheek by a shallow furrow; ocular ridge narrow; frontal limb rather long, abruptly curved downward to the narrow frontal rim.

The form of the head and glabella recalls *P. minor* of the lower portion of the Upper Cambrian sandstones of Wisconsin, but the absence of a nuchal spine and glabella furrows serves to distinguish them.

Formation and locality.—Upper Cambrian (Potsdam Terrane). In limestones on Morgan's Creek, Burnet County, Texas. Collector, C. D. W.

Nat. Mus. Cat. Invert. Foss., 23860.

***Ptychoparia ? urania* sp. nov.**

Plate XXI, Figs. 10 and 11.

Glabella tumid, truncato-conical in outline; surface marked by two pairs of furrows; the posterior pair extend obliquely backward so as to mark off a triangular lobe on each side. Anterior pair shorter and more transverse in their direction; occipital furrow rounded; occipital ring narrow; dorsal furrow strongly defined. Fixed cheeks narrow, posterior extension unknown; anteriorly they merge into the very short

* Geol. Wis., vol. iv, 1882, p. 181, pl. 1, figs. 27, 28.

† Sixteenth Rep. N. Y., State Cab. Nat. Hist., 1863, p. 167, pl. vii, figs. 36-39; pl. viii, figs. 18, 21.

frontal limb; palpebral lobes of medium size and separated from the cheek by a strong furrow; a short oblique ocular ridge crosses the dorsal furrow; frontal limb shown only at the sides, as the glabella arches down to the groove marking off the broad companulate frontal rim; the latter extends forward to a blunt point and is nearly one-third the entire length of the head. The associated free cheek has a broad margin and a relatively small trapezoidal-shaped body beneath the base of the eye lobe.

Surface of the glabella, fixed cheeks, and body of free cheeks strongly pustulose; frontal and side margin smooth.

That this species is not a true *Ptychoparia* is evident; it is so referred with *P. ? pernasutus* and other species, while awaiting a revision of the genera of American Cambrian trilobites.

Formation and locality.—Upper Cambrian (Potsdam Terrane). Packsaddle Mountain, Llano County, Texas. Collector, C. D. W.

Nat. Mus. Cat. Invert. Foss., 23861.

Ptychoparia vacuna sp. nov.

Plate XXI, Figs. 8 and 12.

The portions of the head preserved shows it to have been strongly convex. Glabella slightly converging towards the broadly rounded front; glabellar furrows slightly impressed, three in number on each side, and extending obliquely inward nearly one-third the distance across. Occipital furrow shallow, and arching forward at the center; occipital segment narrow, arching forward and with a small node at the center.

Fixed cheeks practically obsolete, except in their extension into the long, postero-lateral limbs; palpebral lobes unknown; frontal limb very broad, sloping abruptly downward from the faint dorsal furrow in front of the glabella to where it curves forward and merges into the flattened frontal borders. Surface apparently smooth.

Formation and locality.—Upper Cambrian (Potsdam Terrane) Limestone in Spring Creek Cañon, Black Hills, Dakota. Collected under charge of Prof. F. B. Carpenter.

Nat. Mus. Cat. Invert. Foss., 23862.

Ptychoparia (Liostracus) panope sp. nov.

Plate XXI, Fig. 13.

Of the species we have only the portions within the facial sutures.

Glabella convex, sides converging a very little towards the broadly rounded front; glabellar furrows scarcely to be distinguished on the smooth surface; occipital furrow well defined and arched forward at the center; occipital segment a little broader at the center than at the sides, slightly convex and arched forward near the center; dorsal groove distinct all about the glabella.

Fixed cheeks of medium width; palpebral lobes rather long, narrow, and separated from the cheeks by a narrow and distinctly marked groove; a narrow ocular ridge crosses the cheek from the palpebral lobe to the dorsal furrow.

Frontal limb of medium length and bent downward from the dorsal suture to where it curves outward and merges into the flattened border. Surface smooth.

Formation and locality.—Upper Cambrian (Potsdam Terrane) Limestone in Spring Creek Cañon, Black Hills, Dakota. Collected under charge of Prof. F. B. Carpenter.

Nat. Mus. Cat. Invert. Foss., 23856.

Agraulos saratogensis sp. nov.

Plate XXI, Fig. 14.

Bathyrurus armatus Walcott, 1879, 32d Rep. State Mus. Nat. Hist. New York, p. 131.

Ptychoparia (A.) *saratogensis* Walcott, 1886, Bull. U. S. Geol. Survey, No. 30, p. 21.

(Name used only in list.)

Head convex, slightly semi-subelliptical in outline, and terminating in round, short, postero-lateral spines.

Glabella moderately convex, truncate conical, sides converging slightly towards the broadly rounded front, about one-sixth longer than wide; marked by two pairs of slightly indented glabellar furrows that extend inward with a slight backward obliquity; on the casts of the interior of the larger specimens the furrows are scarcely to be seen; occipital furrow well defined and arched forward at the center; occipital segment rising to a short, blunt spine at the center and narrowing towards the sides; dorsal furrow well defined about the glabella.

Fixed cheeks narrow, anteriorly they merge into the broad rounded frontal limb, and posteriorly into the short postero lateral limbs; palpebral lobes small and situated a little in front of the transverse center of the head. The frontal limb about one-fourth the length of the head and curved down to the margin without any intervening furrow.

Free cheeks convex and somewhat tumid, irregularly triangular in outline and without a marginal border. The associated pygidium is convex, strongly lobed and without a distinct marginal furrow. Axial lobe intermarginal, convex, and divided into four annulations and an anterior doublure by four distinct transverse furrows; lateral lobes crossed by three main furrows and two shorter ones, corresponding to the furrow on the lateral lobe of the thoracic segments, thus outlining three anchylosed segments in the pygidium; a fourth segment and the terminal portion are also outlined by a very faint ridge.

Thorax unknown.

This is a very distinctly marked species allied to *Bathyrurus armatus* Billings.*

* Pal. Foss., vol. 1, 1865, p. 411.

Formation and locality.—Limestone of the Potsdam Terrane, 4 miles west of Saratoga Springs, N. Y. Collector, C. D. W.

Nat. Mus. Cat. Invert. Foss., 23863.

Agraulos ? thea sp. nov.

Plate XXI, Fig. 15.

Glabella convex; sides subparallel; front broadly rounded; surface marked by three pairs of slightly impressed furrows; occipital segment narrow, transverse, clearly defined by the narrow transverse occipital furrow; dorsal furrow deep all about the glabella.

Free cheeks subtumid and merging anteriorly into the narrow, rounded frontal limb; palpebral lobe of medium size and situated a little back of a transverse line crossing the center of the head; postero-lateral limbs short and strongly grooved by the marginal furrow; frontal limb very short and rounded into the margin.

The associated pygidium is subtriangular in outline, convex; median lobe narrow, convex, elevated above the general surface of the pygidium; divided by transverse furrows into eight or nine anchylosed segments; both the furrows and the segments are carried out onto the convex lateral lobes.

This species occurs with *Ptychoparia minor* in the lower horizon of the Wisconsin Upper Cambrian section. The characters of the head and pygidium are such that the species is referred provisionally to *Agraulos*.

Formation and locality.—Upper Cambrian (Potsdam Terrane). Osceola Mills, Wis. Collector, Dr. Cooper Curtice.

Nat. Mus. Cat. Invert. Foss., 23864.

Illænurus ? dia sp. nov.

Plate XX, Fig. 6.

Glabella subquadrangular, convex, a little longer than wide and curving downward in front to the slightly arched margin; occipital furrow shallow, arched a little forward midway; occipital segment flat and practically a backward continuation of the glabella; dorsal furrows clearly impressed. Fixed cheek narrow; palpebral lobe rather long, separated by a narrow furrow from the cheek; posteriorly the cheek passes into the postero-lateral limb, the most of which is broken away; anteriorly it merges into a rather broad subtriangular expansion that extends from the palpebral lobe to the frontal margin. Surface apparently smooth.

This little head is distinct from any known to us. It appears to be a link between *Illænurus* and *Bathyurus*, or rather some of the species placed in the latter genus.

Formation and locality.—Upper Cambrian (Potsdam Terrane) Morgan's Creek, Burnet County, Texas. Collector, C. D. W.

Nat. Mus. Cat. Invert. Foss., 23865.

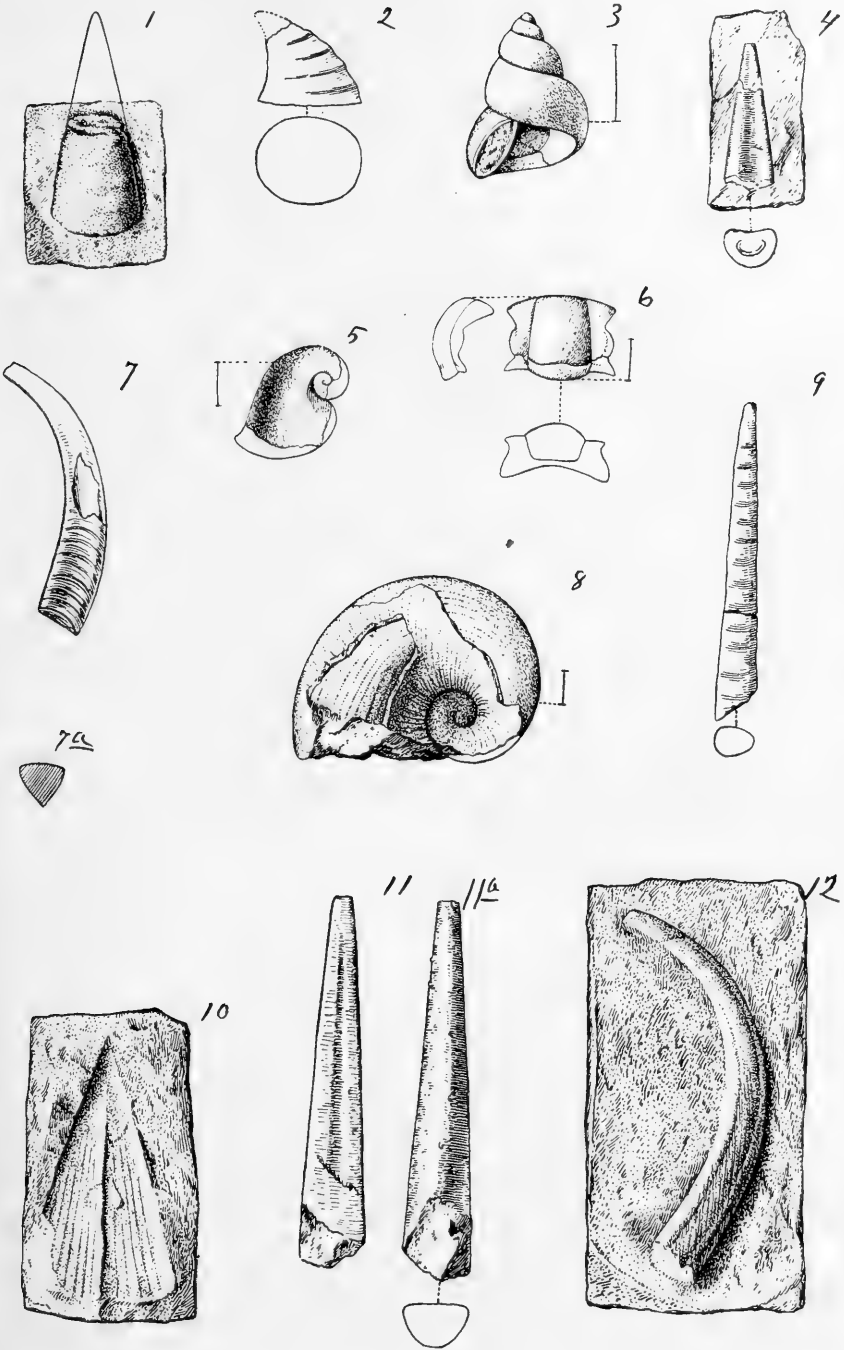
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DESCRIPTION OF PLATE XXI.

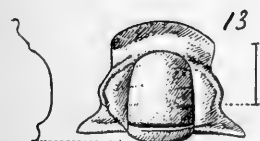
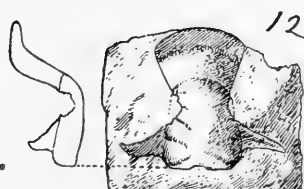
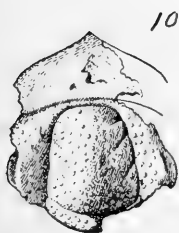
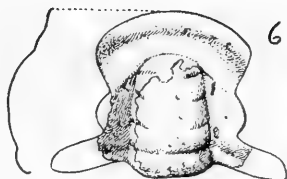
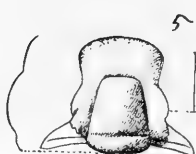
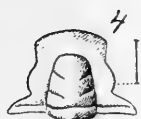
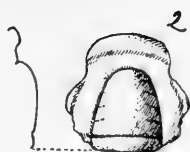
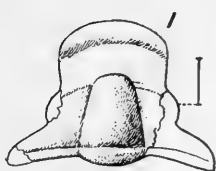
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UPPER CAMBRIAN GASTEROPODA, PTEROPODA, AND TRILOBITA.







NOTES ON TRIASSIC PLANTS FROM NEW MEXICO.

BY

WM. M. FONTAINE AND F. H. KNOWLTON.

(With Plates XXII-XXVI.)

In 1886 a small collection of fossil plants was made by Maj. J. W. Powell at the Copper Mines near Abiquiu, New Mexico, and during the past season (1889) the same locality was visited by Prof. F. H. Knowlton who obtained additional material. The plant impressions were referred to me by Prof. Lester F. Ward for determination, and sections of the wood obtained have been made and studied by Professor Knowlton.

DESCRIPTION OF THE LOCALITY.

By F. H. KNOWLTON.

The little village of Abiquiu stands upon a bluff overlooking the valley of the Chama River, and is about 25 miles northwest of Espanola, the terminal point of the branch of the Denver and Rio Grande Railroad, and about 50 miles northwest of Santa Fé, New Mexico. The general topographic and geologic features of the surrounding country have been so thoroughly described by Dr. J. S. Newberry, who was attached as geologist to the "Exploring Expedition from Santa Fé, New Mexico, to the Junction of the Grand and Green Rivers" under Capt. I. N. Macomb, in 1859, that little remains to be added.

The copper mines which have been known and worked by the Mexicans for a very long time, are about 6 miles northeast of Abiquiu and about 1,000 feet above the valley of the Chama. After leaving the Chama, which on the north side at this point is characterized by a little lateral valley eroded from mostly whitish coarse sandstone probably of Tertiary age, we enter another valley, or rather almost a cañon, which has been cut through Triassic rocks. The sides of this cañon exhibit bands of variously colored sandstones, the colors being red, white, yellow or orange, and the strata being nearly horizontal.

At the top of the mountain a large eroded basin is entered from the southeast. This basin, which according to Newberry drains into the Chama Valley, is about $1\frac{1}{2}$ miles from south to north and 1 mile from east to west, and is surrounded by a wall, in some places nearly vertical, between 500 and 600 feet high. This wall is composed at base of sandstones and marls about 200 feet in thickness, above which is a

stratum of reddish fine-grained sandstones, also about 200 feet in thickness, the whole being capped by a layer of coarse-grained, yellowish sandstones 150 feet or more in thickness.

In some places the second of the above-mentioned strata has the sandstone of a yellowish or nearly white color, and it is in this material on the eastern side that the old copper mines are located. There are but three openings visible at the present time. The openings are 5 or 6 feet square and descend at a slight angle, the deepest being only about 75 feet. Only one is branched, and none of them are braced up with timbers at the present time. At the time the mines were visited by Dr. Newberry they were braced up with heavy timbers, and there was evidence of quite an extensive series of tunnels. It is possible that the mines visited are not the same as those mentioned by Dr. Newberry, as they have been recently worked, and exhibit none of the evidences of great antiquity noticed by him, but these were the only mines known to the guide, who was a native of Abiquiu, and had worked in the mines. The copper occurs as a sulphide of copper and iron, and as iron carbonate, and is distributed through a layer hardly more than 4 feet in thickness. It has replaced the trunks of trees and various vegetable stems and fragments, and also occurs in concretions about and among the quartz pebbles.

Just above the openings of the mines occurs a layer of carbonaceous shale, about 8 inches in thickness, which contains fossil plants. The material splits very readily into thin laminae and is very fragile. The surface of the shale is covered with such a mass of vegetable impressions that it is with considerable difficulty that anything can be made out; but by removing a considerable quantity of the material a fairly clear display of the plants was obtained.

From the same white sandstone, about 10 feet above the shale holding the plant impressions, considerable fossil wood was obtained. One trunk, which was 2 feet 8 inches in diameter, was observed in place in the sandstone, and numerous pieces of greater or less size were scattered about. While only one trunk was actually found *in situ* there is every evidence to indicate that the loose pieces came from the immediate vicinity. The wood is fairly well preserved and, as the microscopic examination showed, retains the structure in a manner which allows its satisfactory study and determination.

The new copper mines, which were opened during the spring of 1889, are in the northwestern part of the basin. They are located in a white very coarse-grained sandstone which, as there exposed, forms the floor of the basin and is consequently several hundred feet lower than the old mines. The copper occurs in the form of wood or stems only. Some of the stems bear evidence of having been large but are now considerably disintegrated. The structure has almost entirely disappeared from these stems, but a carefully selected section shows traces of it to be still retained.

Associated with these stems are the casts of many large and small stems of *Equisetum*; but the matrix is by far too coarse and granular to successfully preserve delicate leaves or fronds.

DESCRIPTION OF THE SPECIES.

By WM. M. FONTAINE.

I.—*Plants of the lower horizon or from the new copper mines.*

Equisetum Abiquiense sp. nov. Fontaine. Plate XXII, fig. 1.

This is preserved in a coarse white sandstone. It is characterized by the considerable width of the ribs, their flatness, and the great number and distinctness of the scars left by the articulation of the leaves. The larger piece must have formed a part of a stem 6 inches in diameter.

This fossil, forming cast No. 1, is much like *Schizoneura planicostata*, Rogers spec., the *Calamites planicostatus* of the Richmond coal field, and may be the same plant. As, however, no impressions of *Schizoneura* have been found in this formation, and as the other fossil found with it is certainly an *Equisetum*, it seems best to regard this as an *Equisetum* also until portions more decisive of character are found. For convenience of reference it may be called *Equisetum Abiquiense*. Two specimens, internal casts.

Equisetum Knowltoni sp. nov. Fontaine. Plate XXIII, Figs. 2-4.

This cast is preserved in a fine grained white sandstone. The casts on their exterior are usually impregnated with malachite, the carbonaceous matter seeming to have been active in precipitating the copper from solution. These impressions evidently were formed by a plant very different from that yielding cast No. 1.

These casts are characterized by the possession of numerous very short internodes, very narrow prominent ribs, and by the entire absence of the scars of leaf-articulations. The shortest internodes are 1 centimeter in length, one specimen (Fig. 4) showing six of these. The longest are 22 millimeters in length. The widest ribs are 1 millimeter in breadth and the narrowest about one-third of a millimeter, and the average is about one-half of the same. In the narrowness of the ribs this plant resembles the internal casts of *Equisetum Rogersi* of the Richmond Coal Field, the impressions that were called *Calamites arenaceus*. The persistent shortness of the internodes, however, is a feature which distinguishes this from the Virginia plant. It might be called *Equisetum Knowltoni*. Six specimens; internal casts.

II.—*Plants of the upper horizon or from the old copper mines.*

As Mr. Knowlton points out, the plants of this higher horizon are totally different from those lower down. I find among them none of the impressions of *Equiseta* that form all of the fossils of the lower horizon.

It must, however, be borne in mind that this difference may in part be due to the accidents of preservation, as the coarse sandstone of the new mine could not preserve imprints of leaves. No previous collector seems to have found fossils at the lower horizon. Dr. Newberry gives no imprints of *Equiseta* from the Abiquiu Copper Mines, and the material collected by Major Powell in 1886, which I have examined, evidently comes from the higher horizon. The shale, however, which carries the impressions collected by Major Powell is more siliceous and indurated than that obtained by Mr. Knowlton, which may be due to the fact that it was got from a different place in the stratum. The following are the plants identified from this locality:

- | | |
|---|---|
| 1. <i>Zamites Powellii</i> sp. nov. Fontaine. | 5. <i>Palissya</i> cone? (specimen 13). |
| 2. <i>Cheirolepis Munsteri</i> Schimp. | 6. <i>Cycadites</i> ? (specimen 23). |
| 3. <i>Zamites occidentalis</i> ? Newb. | 7. <i>Ctenophyllum</i> ? |
| 4. <i>Palissya Braunii</i> ? Endl. | |

Zamites Powellii (Figs. 5-7) occurs as a great rarity among the specimens collected by Major Powell, but is the most common of the imprints found by Mr. Knowlton. It is nearest to *Zamites Feneonis* Brongn., among previous described plants, but does not seem to be identical with it and is probably new. It does not seem to have been found in the plants described by Newberry from Los Bronces and the copper mines near Abiquiu. It has wider and longer leaflets than *Z. occidentalis* Newb., and they are more bluntly terminated than those of *Z. Feneonis* Brongn.

Cheirolepis Munsteri Schimp. is proportionally much less common among these plants than those collected by Major Powell, and the imprints are imperfectly preserved.

One specimen of *Zamites occidentalis*? Newb. was seen and it was too obscure to permit of a positive identification.

Palissya Braunii? Endl. occurs in several specimens. It is certainly a *Palissya* and seems to be very near *Palissya Braunii*, but the specimens are not well enough preserved and large enough to permit of a positive identification. It seems to be the same with the plant figured as *Palissya*? in Newberry's Geological Report of the Macomb Expedition, Plate VI, Fig. 10.

Palissya cone? This fossil, seen in only one specimen, is most probably the cone of a *Palissya*, and probably belongs to the species which has been doubtfully identified with *P. Braunii* Endl. This cone is much like that given by Newberry in his Report on the Geology of the Macomb Expedition, Plate V, Fig. 5. It is shorter and has longer scales than the one given by Scheuk as the cone of *P. Braunii*. (See Foss. Flora der Grenzschichten, tafel XII, Fig. 7.)

Specimen 13 is an obscure imprint, which seems to be a *Cycadites*. This is indicated by the narrow, stiff leaves, narrowed at base to a peduncle and by what seems to be a midrib in the leaves. It is not well enough preserved to be identified with certainty.

Several specimens show long, strap-shaped leaflets, which never possess either base or termination. They look much like *Otenophyllum grandifolium* of the older Mesozoic Richmond Coal Field of Virginia, but are not well enough preserved to be certainly made out. They may be fragments of Newberry's *Pterophyllum robustum*, found at Los Bronces, and this is apparently the same as *Otenophyllum grandifolium*.

These fossils from the copper mines near Abiquiu are not numerous enough and sufficiently well preserved to enable one to determine with positiveness the age of the strata which contain them. They, however, indicate that the beds are not older than the Rhetic.

FOSSIL WOOD FROM THE OLD COPPER MINES.

By F. H. KNOWLTON.

Araucarioxylon Arizonicum Knowlton* is represented by seven pieces of wood which, as stated above, were obtained from sandstone about 10 feet above the shale containing fossil plants at the old copper mines. The material is not as perfectly preserved as that from which the species was described, but it is sufficiently clear to indicate that it is identical with it.

In transverse section the annual rings are found to consist of only three or four layers of tangentially compressed cells as in the type. The remaining cells are of nearly uniform size and possess thick walls.

The radial section is very obscure, and in only one or two limited areas is it possible to demonstrate the presence and outline of the punctations. They are arranged in a single longitudinal row in the center of the cell. No double row of punctations could be detected, but this condition was not of frequent occurrence in the type specimens. The medullary rays consist of relatively short cells as in the type.

In tangential section the medullary rays are observed to be in a single series of superposed cells, and range from one to twenty or more in number. The punctations that were described in the type specimens could not be detected in this material, and, indeed, a further examination of material from the type locality shows that these tangential punctations are not all uniformly present.

Coniferous Wood? As before stated the deposits of copper occur as displacements of vegetable stems, from which, in most cases, the structure has entirely disappeared. Sections were made from exceptionally well preserved specimens from the new copper mines, and these show the outlines of a few cells which are arranged in radial rows and separated by what must be medullary rays, although these latter are only imperfectly preserved. This seems to indicate that it was a solid stem, and from the general appearance it most probably represents a coniferous wood.

* Knowlton in Proc. U. S. Nat. Mus., vol. XI, 1888, pp. 1-4, Pl. I.

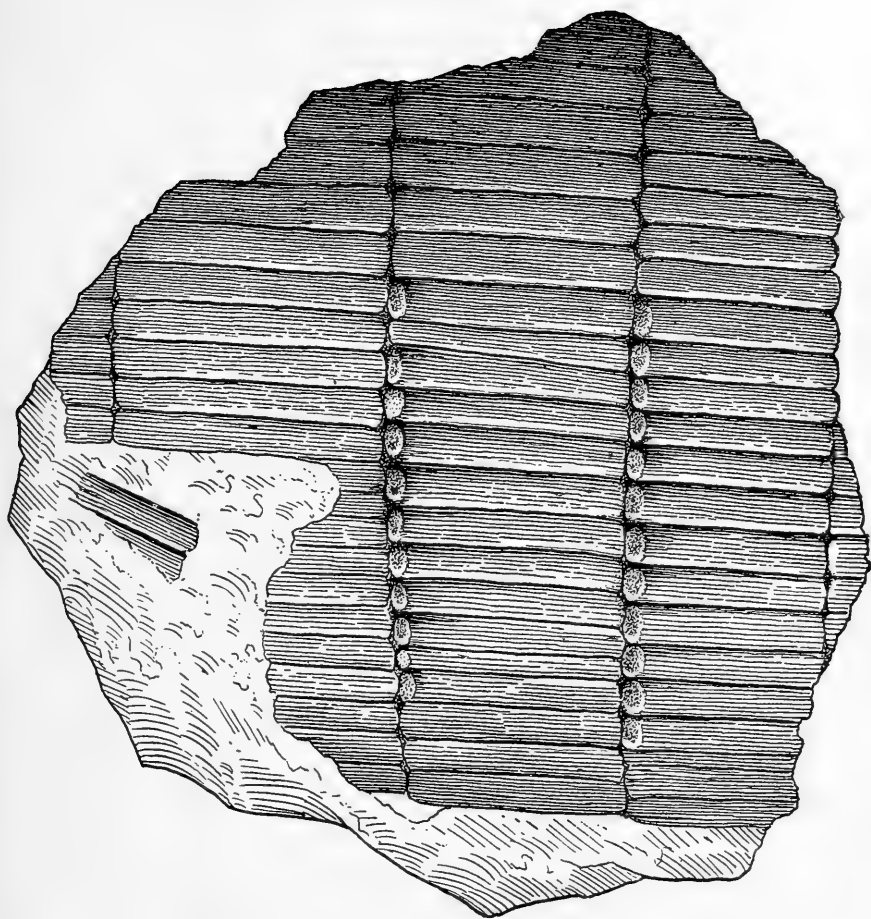


FIG. 1. *EQUISETUM ABIQUIENSE*, new species.



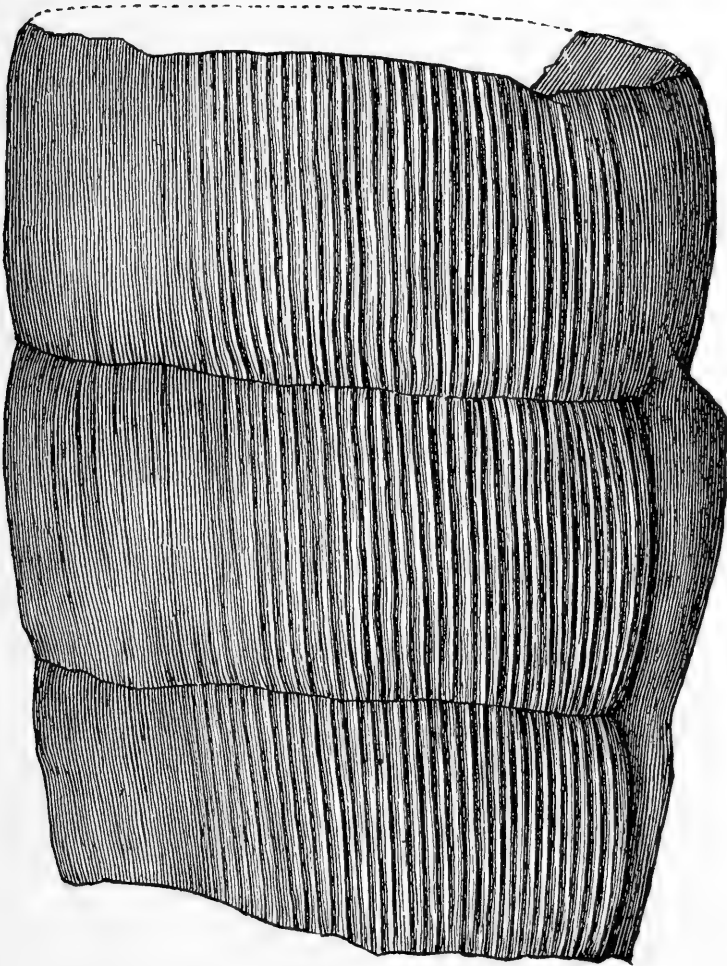
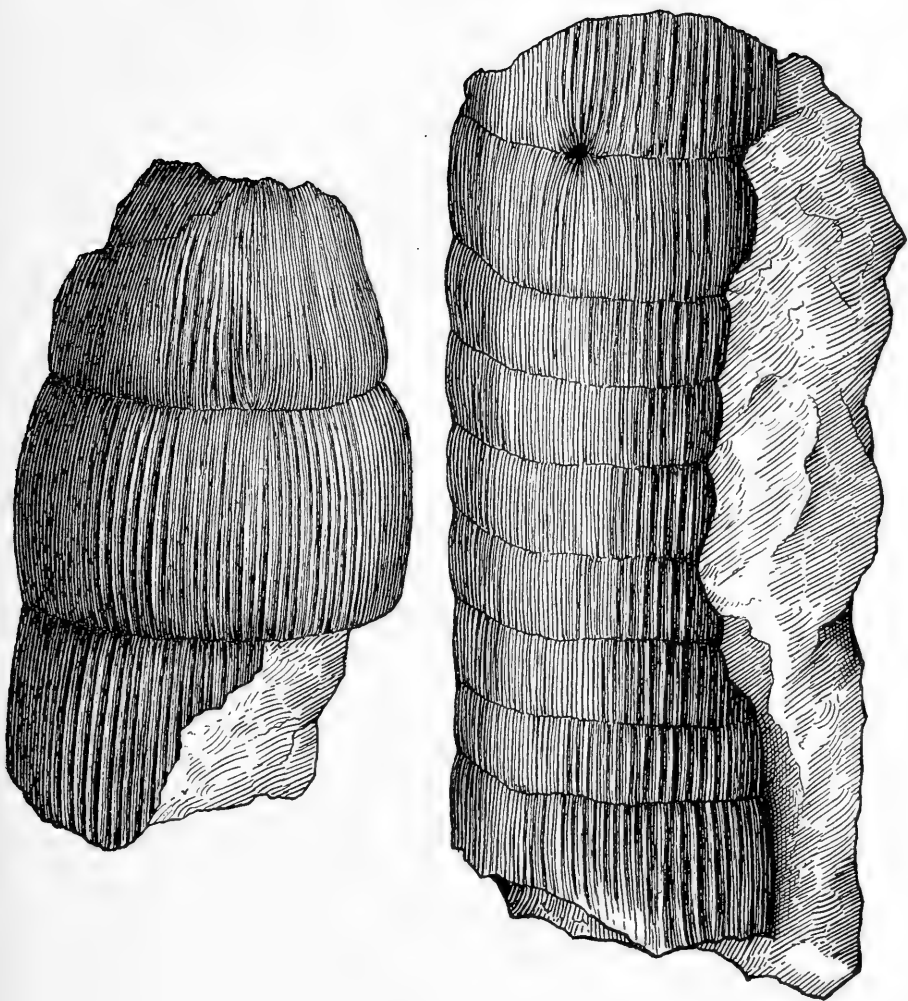
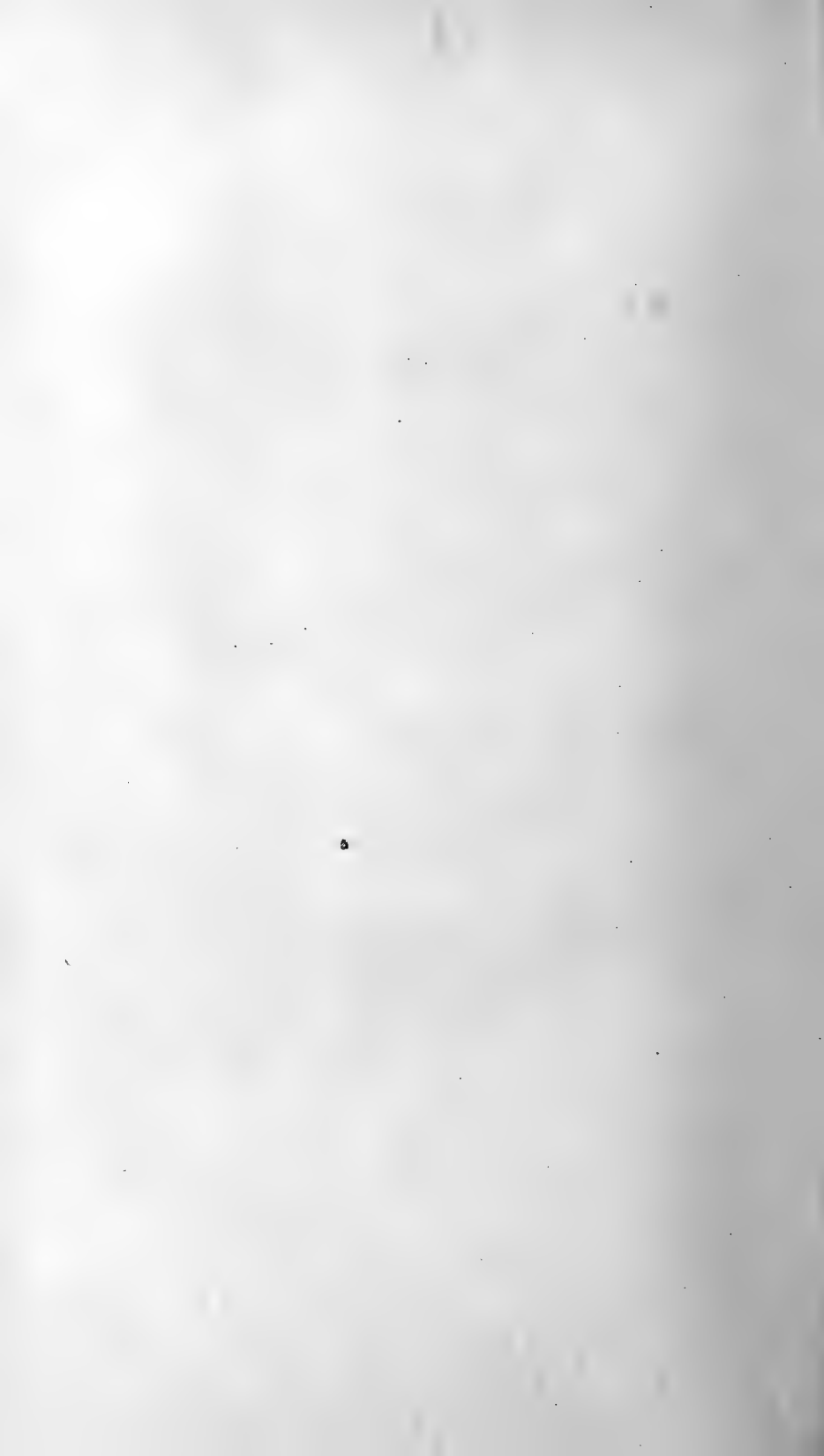


FIG. 2. *EQUISETUM KNOWLTONI*, new species.





FIGS. 3, 4. *EQUISETUM KNOWLTONI*, new species



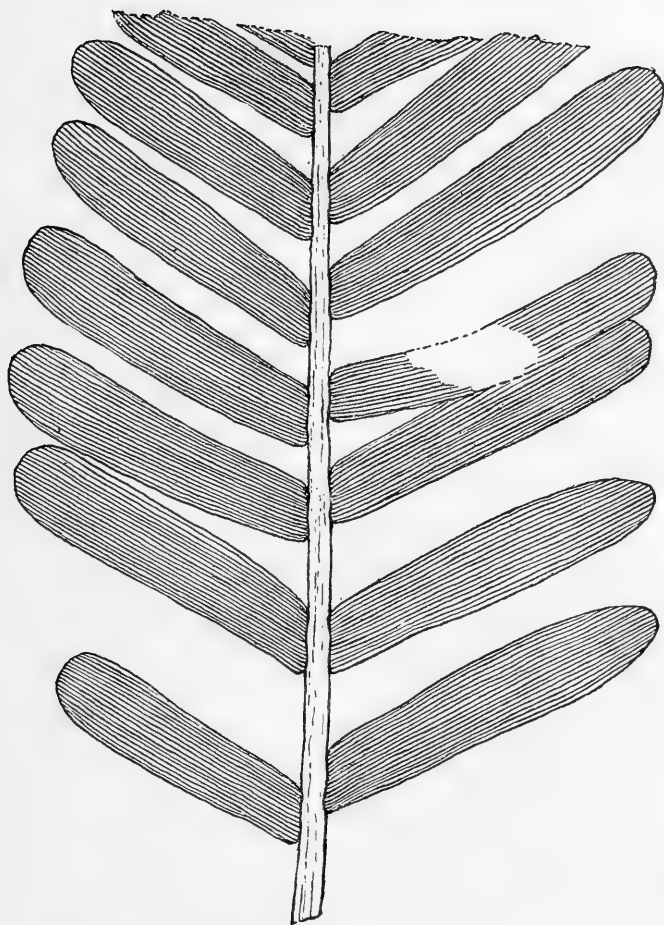
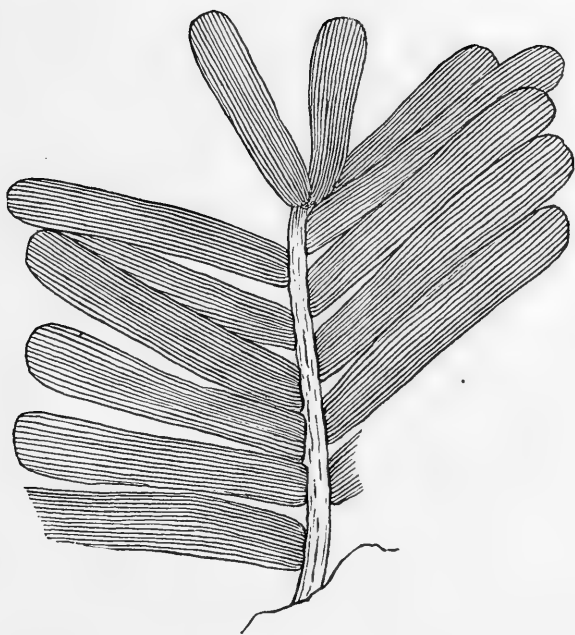
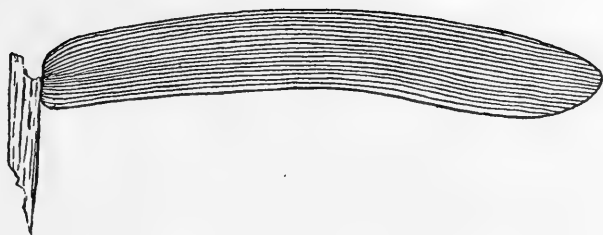


FIG. 5. ZAMITES POWELLI, new species.



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FIGS. 6, 7. ZAMITES POWELLI, new species.



NOTES ON FISHES OF THE GENERA AGOSIA, ALGANSEA, AND
ZOPHENDUM.

BY
DAVID STARR JORDAN,
President of Indiana University.

The genus *Zophendum* Jordan (Bull. Hayden's Geol. Surv. of Terr. IV, 786, 1878) has been defined in the Synopsis Fish N. A. as being a near relative of *Hybognathus*, from which it differs chiefly in the small size of the scales. These generic characters are well shown in *Zophendum australe* Jordan, and in an undescribed species also from Guauajuato. An examination of the specimens figured by Girard, of *Leuciscus tincellus* Cuv. & Val., from the City of Mexico, shows that this species agrees substantially in dentition, intestines, and other characters, notably in the breadth of the suborbital bones, with *Zophendum australe*. But this species is the original type of the earlier genus *Algansea* Girard. The name *Algansea* therefore should be used instead of *Zophendum* for *australis*, *tincella* and their congeners. This leaves the group called *Myloleucus* Cope (*obesus*, *symmetricus*, *bicolor*, etc.,) to retain the name *Myloleucus*, unless they be referred to the European genus *Leucos*.

But the original type of *Zophendum* was *Hybognathus* (misprinted *Hyborhynchus*) *siderius* Cope. An examination of Professor Cope's original types shows that it has no affinity with the other species called *Zophendum*. *Zophendum siderium* has a distinct barbel at the angle of the mouth. Its teeth are 4-4, hooked, with a rather broad grinding surface, and its intestines are moderately elongate, the peritoneum somewhat dusky. It is, in fact, identical with the species described by Girard as *Agosia chrysogaster*. I have compared Cope's types with specimens of the latter from Rio Sonora, Magdalena, Mexico. *Zophendum*, as originally defined, is therefore a synonym of *Agosia*.

Very close to *Agosia* is the group called *Apocope*. This differs in its thicker lips, and in having the teeth mostly 1, 4-4, 1, strongly hooked, and without grinding surface. This is probably a valid genus, although very close to *Rhinichthys* on the one hand and *Agosia* on the other. The fins are considerably higher in *Agosia*, and the intestines are full of vegetable matter.

The species concerned in this discussion may be arranged as follows :

Genus AGOSIA Girard=ZOPHENDUM Jordan.

Agosia chrysogaster Girard=*Hyborhynchus siderius* Cope.

Genus ALGANSEA Girard=ZOPHENDUM, not type.

Algansea tinella (Cuv. & Val). *Algansea australis* (Jordan).

Genus MYLOLEUCUS Cope.

Myloleucus obesus (Girard), etc.

INDIANA UNIVERSITY, April 10, 1890.

DESCRIPTION OF A NEW SPECIES OF ETHEOSTOMA (E. MICROPTERUS) FROM CHIHUAHUA, MEXICO.

BY

CHARLES H. GILBERT,
Professor of Zoölogy, Indiana University.

Etheostoma micropterus sp. nov. (No. 38245 U. S. Nat. Mus.)

Color in spirits: Light olive, sides and above obscurely tessellated with darker. Nine short dark cross-bars on back, and traces of about an equal number on middle of sides, those on front of sides faint, only the last five evident. A black humeral spot present. A faint dark streak downwards and one forwards from eye, and a small dark spot above and behind orbit. Cheeks dusky; top of head vermiculated with dusky brownish. Spinous dorsal with a basal series of small blackish spots, each in the midst of a translucent area, the terminal portion of membrane rendered dusky by minute close-set dark points. Soft dorsal and caudal barred with light and dark lines. Pectorals and ventrals translucent, unmarked. The spinous dorsal probably showed bright colors in life.

Head $3\frac{2}{3}$ in length; depth $3\frac{3}{4}$. Length of caudal peduncle nearly equaling head. Least depth caudal peduncle equals one-half head. D X, I, 11; A II, 7. Lat. l. 45° (pores 31).

Body extremely short and deep, the head short and heavy, moderately compressed. Upper profile of head rounded, no angle above orbits, the short snout with rounded profile but not obtuse. Premaxillaries on level of pupil, non-protractile. Preorbital extremely narrow, little wider than the broad end of the maxillary bone, which is not concealed by it. Gill-membranes rather narrowly united across the isthmus, their width antero-posteriorly one-half diameter of eye. Opercular spine bifid, with two minute free points. Preopercle entire. Eye large, 4 in head to end of opercular spine. Interorbital space wide, strongly convex, its width equaling length of snout, $5\frac{1}{2}$ in head.

Fins all small. Distance from front of dorsal to tip of snout one-third length. Dorsals low, the two joined at base, the last spine appearing longer than the preceding one, and belonging to the second dorsal. Longest dorsal spine one-third head. Length of last dorsal spine two-thirds diameter of orbit, the spine erect and connected for its entire height with the following soft ray. The next to the last spine is directed

very obliquely backwards and appears much shorter than the last spine, its membrane joining last spine at base only. Base of spinous dorsal as long as head in front of preopercular margin, its highest ray half head. Anal fin very small, the spines large and strong; first spine much longer and stronger than the second, $3\frac{1}{3}$ in head, equaling length of snout and half eye. Highest soft ray of anal equals length of snout and eye. Pectorals and ventrals both very small; the pectoral short, broad, and rounded, reaching the same vertical as ventrals, $1\frac{1}{3}$ in head, and having but 11 rays. Ventrals $1\frac{1}{2}$ in head.

Sides of head, breast, and nape wholly naked. Body with rather large ctenoid scales, uniformly covering belly. Lateral line straight, incomplete, reaching to below middle of soft dorsal.

A single specimen, $1\frac{3}{4}$ inches long; collected by Mr. E. Wilkinson, at Chihuahua, Mexico.

DESCRIPTION OF A NEW SPECIES OF BAT OF THE GENUS CAROLLIA, AND REMARKS ON CAROLLIA BREVICAUDA.*

BY

HARRISON ALLEN, M. D.

Carollia is one of the most common of the South American leaf-nosed bats. Notwithstanding its wide range of distribution (it is found from Mexico to the southern limit of Brazil, including the Antilles), the type of the genus is that of the single species also. I have recently examined this form—*Carollia brevicauda*—with the object in view of determining whether or not an example of *Carollia* in the collections of the National Museum might prove to be new.

The facts which led me to suppose that this might be the case were the following:

The specimen was smaller than *C. brevicauda*; the color was of a light chestnut-brown tint, instead of the ashy shade of *C. brevicauda*. The interfemoral membrane was not incised. The nose-leaf was relatively small, delicate, with entire, rounded nostrils, and the lower border sharply defined to a point near the median line, where a small naked space alone was seen.

I have had a knowledge of these facts for a long time, but I hesitated to describe the form as new, for in general appearance in the proportions of the membrane, in the form of the ear, in the markings of the wing membranes, and the shapes of the terminal phalanges the two forms appeared to be essentially the same. I had but a single specimen—a young male from Costa Rica. I concluded that before describing it an examination of all the specimens of *Carollia* should be made. A large number of specimens of the genus were available for the purpose from the collections of the Museum of Comparative Zoölogy, but unfortunately nine only of the twenty-six examples were in good condition.

From among these a young male was found, and I was thus able to

* Read before the American Philosophical Society, December 6, 1889, and printed in the Proceedings of the Society, Vol. xxviii, 1890, pp. 19-26, with a figure of the species. It is here reprinted as a paper based upon a study of the collections of the National Museum.

show that the smaller size of the specimen, as well as the difference of coloration of the new form, as compared with the old, were not due to age.*

As a result of this examination, I venture to describe the single example as a type of a new species in the following language:

Carollia castanea sp. nov.

Smaller than *C. brevicauda*. Fur long and silky. Above, lustrous light chestnut-brown at basal one-half and at the tip. The intervening portion is yellow brown (old gold). Below, the same colors prevail, excepting that over the abdomen and pubis the brownish tip is absent and the body of the hair not golden. There is no hair on the forearm (the parts are slightly rubbed), and scarcely any on the dorsum of the metacarpal bone of the thumb. The distribution of the hair on the wing membrane is as in *C. brevicauda*.†

The general form of the auricle as in *C. brevicauda*, but is proportionately longer. The outer border is more emarginate. When the auricle is laid on the head, it reaches a point as far as the end of the muzzle. The tragus is obscurely acuminate; the inner border, therefore, not straight, but the apical half abruptly narrowed. The outer border crenulate rather than pectinate. The basal lobe and the process above it well developed. The nose-leaf is more delicate than in *C. brevicauda*. The height is 7^{mm}; the breadth 4½^{mm}. The lower border is much more distinct than in *C. brevicauda*. The nostrils are rounded, well defined, and not continuous with a concavity on the outer border.‡ The warts on the mentum are arranged in three obscurely disposed rows, the middle one being the larger, but none of them are elongate. The tail reaches to a point opposite the knee.

Skull.—The general proportions of the skull are the same in the two species. The brain case at the procephalon is inflated and the temporal crest does not extend over the inflated part. Hence the impressions

* The teeth were all erupted, the epiphyses of the radii, metacarpals, and phalanges were united to their shafts, but the tibia was slightly flexible and the foot was covered by a looser skin than is seen in matured individuals. It is not always easy to determine the age of bats.

† The fur of *C. brevicauda* is described as follows:

Above, moderately long only. The base is plumbeous, the tip brown, and the intermediate part pallid—almost white. Below, the fur is short, plumbeous at basal half, and of the peculiar mouse-gray so often seen in Phyllostomidae. G. E. Dobson (Cat. Chir. Br. Mus., 1878, describes the fur as brown above and beneath. None of the nine specimens examined were so marked. The brown aspect of the animal as seen in spirit is much more apparent than when dried. The nose-leaf is covered with fine short hairs on both sides. The back of the thumb is densely covered with short hair in *C. brevicauda*.

‡ The nostrils are oval in outline, are not separable from the outline of the nose-leaf above, and are continuous with a concavity (as one speaks of the mouth of a pitcher being concave) on the outer border. The peculiarity just named is best seen by holding the specimen so as to keep the vertex of the head upward and looking downward from the tip to the base of the nose-leaf.

for the temporal muscles are not defined on the frontal bone. The upper border of the anterior nasal aperture is on a line with the canine tooth. The distance between the lachrymal ridges is greater than between the lachrymal ridge of one side and the corresponding central incisor. The distance from the last maxillary molar to the posterior limit of the nasal chamber is less than the distance from the point last named to the end of the long endopterygoids. The palatal rugæ are more trenchant, curved, and wider apart opposite the premolars, than is the case with *C. brevicauda*.

Teeth.—The number of the teeth is the same as in *C. brevicauda*, viz:

$$\frac{2}{2} - \frac{1}{1} - \frac{2}{2} - \frac{3}{3} \times 2 = \frac{16}{16} = 32$$

The maxillary central incisors touch their entire lengths.* The lateral incisors are very small and are free from both the central incisor and the canine. The first premolar is distinctly caniniform and does not touch either the canine or the second premolar.

The mandibular second premolar does not touch the third premolar. The distance from the anterior border of the canine to the first molar is 3^{mm}, a distance over $\frac{1}{2}$ ^{mm} greater than that from the anterior border of the canine to the central incisors.

Measurements.

	mm.
Head and body (from crown of head to base of tail)	44
Length of arm	25
Length of forearm	32
First digit:	
Length of first metacarpal bone	4
Length of first phalanx	3
Second digit:	
Length of second metacarpal bone	26
Length of first phalanx	3
Third digit:	
Length of third metacarpal bone	32
Length of first phalanx	16
Length of second phalanx	20
Length of third phalanx	10
Fourth digit:	
Length of fourth metacarpal bone	30
Length of first phalanx	13
Length of second phalanx	11
Fifth digit:	
Length of fifth metacarpal bone	32
Length of first phalanx	11
Length of second phalanx	10
Length of head	15
Height of ear	15

* G. E. Dobson (Cat. Chir. Br. Mus., 1878) gives this as a character of *C. brevicauda*. From my examinations, I can not agree with this writer. The teeth exhibit a A-shaped space between the cutting edges.

	mm.
Height of tragus.....	6
Length of thigh	11
Length of tibia	13
Length of foot.....	10
Length of intermembral membrane.....	15
Length of tail	8

Costa Rica. Collections of National Museum. Collected by J. C. Zeledon.

The nine specimens of *C. brevicauda*, which formed the basis of my study, were chiefly interesting from the measurements which were made of the peripheral parts. These are arranged in tabular form:

Table of measurements.

Carollia brevicauda.										Carollia castanea.
	3997 ♀	3129 ♀	3128 ♀	3231 ♀	3998 ♀	3993 ♀	3230 ♂	3229 ♂	4192 ♂	12914 ♂
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Arm*	26	26	26	28	25	25	26	27	25	25
Forearm†	37	37	39	40	37	38	38	39	35	32
I { Metacarpal.....	5	5	5	5	4	6	5	5	5	4
I { First phalanx	4	6	5	5	4	4	5	4½	4	3
II { Metacarpal.....	24	30	30	27	30	31	31	28	28	26
II { First phalanx	3½	5	4	4	3	3	5	4	3½	3
III { Metacarpal.....	34	37	37	36	35	-----	37	36	35	32
III { First phalanx	13	17	17	17	14	16½	17	15	16	16
III { Second phalanx	21	22	22	21½	20	22	21	18	21	20
III { Third phalanx	11	11	11	11	11	11	10½	11	10	10
IV { Metacarpal.....	32	36	36	35	34	34	34	34	34	30
IV { First phalanx	13	13	13	11	13	13	14	12½	13	13
IV { Second phalanx	14	12½	12½	10½	13	12	13	11	12	11
V { Metacarpal.....	36	37½	37½	35	35	35	36	36½	35	32
V { First phalanx	11	12	12	12	12	12	12	11	12	11
V { Second phalanx	11	11	11	11	11	12	10½	10	11	10
Femur	14	14	15	12	13	12½	14	12	12	11
Tibia	14	14	17	16	15	15	18	18	14	13
Foot	11	11	11	11	11	11	11	11	11	10
Tail	7½	5	7	6	7½	7½	7	7	13	8
Head	22	22	22½	24	22	22	23	22½	23	20½
Auricle‡	12	12	13	13	12	13½	12	12	12	15
Tragus§	6	5	6	6½	6	6	6	6	6	6
Width of second digital interspace.....	6	4	5	5	4½	6	6	-----	5	4
Width of third digital interspace.....	22	16	20	21	23	21	19	20	20	21
Width of fourth digital interspace.....	31	28	32	31	35	35	26	27	28	30

* From top of shoulder to epicondyle.

† From epicondyle to end of radius.

‡ From outer border posteriorly.

§ Outer border.

With the exception of the foot, which is constantly 11^{mm} long, all the measurements are subject to variation—indeed, no two specimens in all respects are alike. This statement is made while making due allowance for the difficulty in taking some of the measurements, as for example those of the thigh and of the membranous expansions. Specimens which had been macerated in weak alcohol were rejected. But among those which were accepted it was not always possible to determine (owing to the contraction of the tissues), the exact extent to which the parts should be extended, so as to represent as far as possible the posi-

tion of the wings in flight. One of the most interesting measurements is that of the width of the third digital interspace. This space, so small in *Pteropidae*, *Molossi*, and in *Noctilio*, is wide in *Phyllostomidae*, excepting *Phyllostoma*. Another interesting feature is the extent of the incision on the free margin of the interfemoral membrane. In well-preserved specimens of *C. brevicauda* the incision is conspicuous, while in the type of *C. castanea*, which is also in good condition, the incision is absent. Yet in slightly macerated specimens of *C. brevicauda* the incision disappears, showing that it is a character which is dependent upon tonicity and not on any distinctive structural peculiarities, and can not, therefore, have much value. One of the marked ranges of measurements is seen in the length of the tail. The shortest tail is 5^{mm}. long and the longest 7^{mm}. The tip of the tail answered in three specimens to the middle of the femur, in four to the junction of the middle with the lower third, and in two the tail lacked one-fifth only in being as long as the femur. In none, therefore, was the tail as long as in the single example of *C. castanea*.

The length of the thigh varies from 12 to 15^{mm}. Hence the relative lengths of these quantities will be also variable, especially so since even in the same individual the length of the tail does not tautogenize* with the length of the femur. The length of the tibia—a character of value in Cheiroptera—varies from 14 to 18^{mm}. The length of the fore-arm, perhaps the most important single measurement which can be taken, varies from 35 to 40^{mm}.

The following includes the variations of the manus and their range:

	From—	Range.
	<i>mm.</i>	<i>mm.</i>
First metacarpal.....	4 to 6	2
Second metacarpal.....	24 35	9
Third metacarpal.....	33 37	4
Fourth metacarpal.....	32 36	4
Fifth metacarpal.....	35 37½	2½
First phalanx, first digit.....	4 6	2
First phalanx, second digit †.....	3 6	3
First phalanx, third digit.....	13 17	4
First phalanx, fourth digit.....	11 14	3
First phalanx, fifth digit.....	10 12	2
Second phalanx, third digit.....	20 21½	1½
Second phalanx, fourth digit.....	10½ 14	4½
Second phalanx, fifth digit.....	10 12	2
Third phalanx, third digit.....	10 11	1

The length of the head appears to be subject to very slight variation, namely, from 22 to 23^{mm}. That of the ear, from 12 to 13½^{mm}, a slight difference, and yet one which might disturb the novice in attempting to identify the species, since the proportion between the height of the ear and the length of the muzzle is so often used in descriptions of bats.

* Tautogeneity—a word introduced by Professor Rolleston as a more correct term in this connection than correlation.

† An apparent anomaly exists on the left side of specimen No. 3993. There are two phalanges to the second digit.

In *Carollia* these quantities are not fixed. The height of the auricle is variable, but the length of the muzzle is constant. No estimate of relations of measurements between them can be undertaken.

The tragus varies in height from 5 to 6^{mm}. It presents different degrees of thickness along the median border. As a rule very thick, this border may be thin and membranous. The processes on the outer border may be two or five, those toward the apex of the tragus tending to merge in one another. This tendency appears to be most marked in males.

The size of the nose-leaf is constant, being 10^{mm} high and 6^{mm} broad. The lower border shows striking peculiarities in some specimens.

Three of the males exhibited warts arranged in one or two rows across the upper lip on the line occupied in *Artibeus*, *Phyllostoma*, etc., with a well-defined ridge or border. This variation is one of generic rather than specific value. At least it does not indicate any disposition to reversion to *C. castanea*, since in this species no warts are seen, the intervals between the margins of membrane at the side of the base of the nose-leaf simply being smaller than usual, and giving to the eye the appearance of extending directly across the lip. I know of no genus in which this variation of the nose-leaf of *Carollia brevicauda* is a constant character.

In *C. brevicauda*, the warts in the second row on the mentum are elongate in all the nine examples, except one in which they are rounded and do not differ from those of the first row. This arrangement resembles that seen in *C. castanea*.

It is probable that the two outermost rows of warts in *C. brevicauda* coalesce to form the elongate wart, which, as a rule, exists.

In reviewing the measurements of *C. castanea*, when placed in tabular form with those of *C. brevicauda*, it is seen that in the species first named that many of the measurements are the same; that is to say, in some one of the examples of *C. brevicauda* the measurement of a given part will be found to be the same as in *C. castanea*. Thus the arm is of the same length in three specimens of *C. brevicauda*. The length of the bones of the digits find their complements in *C. brevicauda*, excepting the metacarpals of the fourth and fifth digits, which are shorter than in any example of that species. The metacarpal of the first digit is of the same length in one specimen of *C. brevicauda*, while the first phalanx is shorter than in any. The head is shorter while the ear is longer. The tragus remains the same in the two species. The thigh and the leg are both shorter in *C. castanea*, while the tail is absolutely longer by 1^{mm}.

The proportion of the widths of the second, third, and fourth interdigital spaces is shown to be subject to variation. Specimens numbered 3129, 3231, 3128, 3230, 3229, and 4192 are of those in the best condition; and it is seen that the differences are less than in the remaining specimens. But after all possible sources of error are eliminated, it will be

seen that in three only of *U. brevicauda* (the males, Nos. 3230, 3229, 4192—and thus suggestive of sexual distinction) is the difference between the widths of the second and third spaces less than 10^{mm}, while in the single example of *U. castanea* (also a male) the difference amounts to but 9^{mm}.

In this connection I may allude to the value which attaches to the last named measurements in the study of the Cheiroptera.

If a specimen of a bat, which is preserved in spirit, is so held in the hand that the wing is supported in the position of flight, it will be seen that the intervals between the metacarpal bones hold a definite relation to each other.

The width of the spaces between the metacarpals, now being recorded (the measurements are taken at their widest parts), it will be seen that the second interspace is the narrowest and the fourth the widest. In this way a formula may be stated. It is proper to add the length of the forearm to the formula, since this measurement is one of relative constancy and is of importance in framing the diagnosis of the species.

Examination of the table herewith presented exhibits at a glance the marked contrasts which obtain in the *Phyllostomidae* in the composition of this formula.

It is especially interesting to note the difference which exists between the widths of the second and third interspaces. It will be observed that no two formulæ are alike, nor is any fixed ratio preserved between the formulæ of genera which are allied. Nevertheless the measurements are sufficiently distinctive to warrant the recommendation that they be taken in all discriminating studies, not only of the *Phyllostomidae*, but of the entire order.

Formulae of the widths of second, third, and fourth interspaces in the genera of Phyllostomidae.

	II.	III.	IV.	Forearm.	Difference between III and IV.
	mm.	mm.	mm.	mm.	mm.
Lophostoma.....	7	17	18	49	1
Schizostoma.....	3	16	21	32	5
Macrotus.....	2	15	22	44	7
Desmodus.....	2	21	37	53	10
Vampyrus.....	3	17	27	36	10
Sturnira.....	3	21	31	38	10
Chilonycteris.....	1½	15	17	40	12
Carollia.....	5	20	32	26	9-12
Vampyrus.....	16	41	53	105	12
Lonchoglossa.....	3	19	32	33	12
Monophyllus.....	3	17	34	32	14
Artibeus.....	4	21	39	51	18
Brachyphylla.....	3	25	43	64	18
Mormoops.....	3	16	35	50	19
Phyllostoma.....	4	29	62	81	45
The following includes the formulæ in families other than the Phyllostomidae:					
Rhynchonycteris.....	5	16	25	40	9
Cynopterus marginatus.....	10	18	27	58	9
Vespertilio murinus.....	2	11	31	59	10
Epomophorus franqueti.....	13	21	39	83	11
Rhinopoma.....	3	13	30	64	17
Atalapha.....	0½	9	26	37	15
Molossus rufus.....	0½	5	35	46	30
Noctilio.....	2	13	58	83	45
Pteropus edwardsii.....	18	17	69	145	52

The study of measurements has given valuable results in the study of the human cranium and has enabled anatomists to come to definite conclusions respecting the validity of characters even when derived from scanty and imperfect material.

No reason can be urged why similar methods may not prove acceptable in describing a new species of mammal.

Extended observations on a number of examples of allied species enhance the value of those upon which it is proposed to announce a new one.

OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY AMPHIPNOIDÆ.

BY
THEODORE GILL, M. D., PH. D.

The genus *Amphipnous* has been generally associated with the typical *Symbranchidæ* in the same family. By Dr. Bleeker it was, indeed, long ago isolated as the representative of a peculiar one (*Pneumobranchoides*), but even he subsequently reduced it to the rank of a subfamily of his *Synbranchoides*. Professor Cope again combined it with *Symbranchus* in his family *Symbranchidæ*, segregating the two in an order (*Holostomi*) contrasting with the *Monopteridæ* constituting his order *Ichthyocephali*. The order *Holostomi* was defined in the following terms:

HOLOSTOMI.

"Epiclavicle suspended to fourth vertebra, post-temporal wanting. Parietals in contact. Mouth bordered by the premaxillaries, which are in contact medially and bounded behind by maxillary. Symplectic present; vertebræ unaltered; no pectoral fin. Third superior pharyngeal not smaller than fourth.

"One family, the *Symbranchidæ*, with the genera *Amphipnous* and *Symbranchus*."

The "epiclavicle [is not] suspended to fourth vertebra" in the skeleton of *Amphipnous* examined by myself, but is nevertheless free and not "suspended to post-temporal and to cranium" as in the *Ichthyocephali*; *Amphipnous* is therefore doubtless the type of the *Holostomi*. *Symbranchus*, however, has been asserted by all except Professor Cope to have the "humeral arch attached to the skull." If this is the case, the true *Symbranchidæ* do not belong to the Copean order *Holostomi*, but rather to the *Ichthyocephali*. Possibly Professor Cope based his conclusions on an erroneously named skeleton of *Amphipnous*. At any rate, there appears no reason to doubt that *Symbranchus* actually has the humeral arch connected with the cranium. In such case, *Amphipnous* should be accepted as the representative of a peculiar family, *Amphipnoidæ*. Inasmuch, however, as it agrees in so many characters with the *Symbranchidæ* and *Monopteridæ*, it would appear better to retain all in the same order, in spite of the fact that generally the attachment or freedom of the scapular arch is of ordinal importance.

The characteristics of the *Amphipnoideæ* as a family are as follows :

AMPHIPNOIDÆ.

Synonyms as family names.

- = *Pneumobranchoidei* *Bleeker*, Enum. sp. Piscium Archipel. Ind., p. xxxii, 1856.
- = *Amphipnoideæ* *Gill*, Arrangement Fam. Fishes, p. 20, 1872.
- = *Amphipnoideæ* *Gill*, Standard Nat. Hist., v. 3, p. 100, 1885.
- Anguilliformes* sp. *Cuvier et al.*
- Muraenidæ* gen. *Bonap.*
- Sphagebranchidæ* gen. *Richardson* (1845).
- Anguillares* gen. *Müller* (olim).
- Synbranchidæ* gen. *Swainson, Müller, et al.*

Synonyms as subfamily names.

- = *Pneumobranchini* *Bleeker*, Atlas Ich. Indes Néerland, t. IV, p. 117, 1864.
- = *Amphipnoina* *Günther*, Cat. Fishes. B. M., v. 8, p. 12, 1870.

DIAGNOSIS.

Holostomous Symbranchians peculiar in the development of a pair of bladders behind the head (one on each side of the nape) receiving a portion of the blood from the branchial artery and with the branchiæ reduced (to laminae on the second branchial arch).

DESCRIPTION.

Body anguilliform, anteriorly subcylindrical, behind compressed, especially in the caudal portion; with the anus far behind in the terminal fourth of the length.

Scales minute, arranged in longitudinal rows.

Lateral line distinct, arched forwards, straight behind.

Head small, ovate-conical, without external prominences.

Eyes within the anterior fourth of the head, directed mostly sideways, of small size.

Nostrils mostly superior; the posterior above the orbit and provided with a valve, the anterior advanced forward on the snout and subcircular.

Jaws well developed; the intermaxillines and supramaxillines connected immovably with each other and with the front of the cranium; *intermaxillines* with a rather broad surface and with projecting processes in front; *supramaxillines* appressed to the upper surface of the intermaxillines forwards and curved upwards and backwards and expanded vertically downwards behind. *Mandible* stout; *dentary* differentiated by its hard compact structure, with its external surface deeply incised for the articular and with its terminal portion expanded upwards into a broad high coronoid process; *articular* long, with a wide cotyloid cavity separated by a considerable interval from the dentary, with an attenuated portion applied to the inner surface of the dentary and fitting into the deep notch of the external wall of the dentary;

angular well developed, forming the posterior border of the mandible and extending into an external notch between the dentary and articular.

Teeth mostly curved, conic or bent backwards, and rather blunt; moderate and uniserial on the jaws except in front, where they extend on a short row on each side of the symphysis of the upper jaw forwards and where they extend in a projecting group in the dentary; enlarged and uniserial on the vomer and palatines.

Lips membranous; the lower reverted over the jaw.

Tongue well developed; free in front and on the sides.

Periorbitals incomplete, the preorbital alone (apparently) being developed; that bone has a wide expanded surface in front and its upper edge united with the external edge of the nasal, while the lower edge is applied to the intermaxilline and its posterior edge about the middle emits a long linguiform process backwards.

Opercular apparatus well developed; *operculum* lamelliform and semihastiform, the upper edge being nearly straight and the lower projecting downwards; *suboperculum* rather wide below and projecting backwards beyond the operculum; *interoperculum* thickened and connected behind with the suboperculum and in front with the angular of the lower jaw; *preoperculum* well developed and closely appressed to the suspensorium; a triangular vacuity intervenes between the operculum, interoperculum, and preoperculum.

Branchiotremes confluent into a single external transverse lunate fissure in the thoracic region.

Branchiostegals six, segregated into two groups; one, of two comparatively slender rays arising from the lateral surface of the ceratohyal near the edge; the other, of four stouter rays arising from a groove hollowed out of the outer surface of the ceratohyal and epihyal.

Dorsalis reduced to a fold on the tail; *caudalis* rudimentary; other fins suppressed.

Branchial apparatus peculiarly modified; branchial arches deflected backwards and with the ceratohyals of the fourth at their tips connected with articular surfaces on the proximal edges of the proscapulæ, and with the arches segregated in two groups, the first and second approximated and the third and fourth approximated and remote from the anterior; with a well developed *glossohyal* and a short hastiform *urohyal*, and only the first basihyal ossified; the *hypohyals* of the first arch normally developed and connected with the basihyal; of the second arch, normal and connecting with each other; of the third shoved out of place sideways, and of the fourth shoved together so that the posterior sides meet in the middle and the bones partly intervene between the preceding hypobranchials of the third arch; *ceratobranchials* of four arches ossified; *epibranchials* of first arch suppressed, of other arches developed and deflected downwards at acute angles with the ceratohyals; of the second arch with a broad base, corresponding to the expanded tip of the ceratohyal; of the third and fourth arches

comparatively long and slender; *pharyngobranchials* of third and fourth arches developed as dentigerous *epipharyngeals*, which are closely apposed to each other and of nearly equal size; *hypopharyngeals* falciform and beset with pauciserial teeth; *branchial filaments* reduced and mostly confined to the second branchial arch.

Respiration supplemented by a pair of bladder-like sacks developed behind the head (one on each side of the nape), having "thin, semi-transparent, membranous parietes" and receiving a portion of the "blood contained in the branchial artery" for aerification.*

The family has but one genus, viz:

AMPHIPNOUS Müller Abhandl. Akad. Wissensch. Berlin, 1839, p. 246,† 1841=*Ophichthys* Swainson, Nat. Hist. Fishes, etc., v. 2, pp. 196, 336, 1839 (not of Ahl, 1789)=*Pneumabranhus* McClelland, Calcutta Journ. Nat. Hist., v. 5, p. 192? 1844.

Type *A. cuchia*, ex Buch.

The skeletons which have served for the present description have been extracted from dried specimens of the *A. cuchia*, for which I am indebted to W. L. Slater, esq., the assistant director of the Indian Museum of Calcutta.

The postcephalic bladders and branchial apparatus have been described and illustrated by Hyrtl (Denkschr. k. Akad. Wiss., (Wien.), Math. Nat. Cl., v. 14, pp. 39-45, pl. 1858.

* Das Herz des *Amphipnous* is kein Venenherz, wie das aller übrigen Fische, sondern ein *Cor arterioso-venosum*, wie jenes der Amphibien.—Hyrtl, o. c., p. 42.

† The name *Amphipnous* occurs (op. cit.) on p. 246 (not 244), but the remarks on the *cuchia* commence on p. 244.

DESCRIPTION OF A NEW SPECIES OF MOUSE, *PHENACOMYS*
LONGICAUDUS, FROM OREGON.

BY

FREDERICK W. TRUE.

Curator of the Department of Mammals.

The Smithsonian Institution has recently received from one of its valued correspondents, Mr. Aurelius Todd, of Eugene City, Oregon, a dry skin of an interesting and apparently undescribed species of mouse. It belongs to the genus *Phenacomys*, recently established by Dr. C. H. Merriam, but, unlike the species described by that author, resembles the field-mice of the genus *Hesperomys*, rather than the *Arvicoline*, or meadow-mice. This arises chiefly from its possessing a long tail like the field-mice, and I have therefore chosen for the species the name of *Phenacomys longicaudus*.

Phenacomys longicaudus sp. nov.

Size moderate, about equaling that of *Hesperomys leucopus*. Ears moderate, nearly concealed by the surrounding fur. Hind foot not relatively longer than in the other species of the genus. Tail long; with the hairs, equal to the body in length.

Color above nearly uniform bright rusty brown; only the tips of the hairs are of this color, the remainder being dark plumbeous. Mixed with the brown-tipped hairs are numerous longer black hairs. Under surfaces white, slightly tinged with rusty brown, especially on the abdomen. The hairs of the throat are white to the base, but elsewhere they are only tipped with light color, the lower portions being plumbeous.

The tail is dusky chocolate-brown above and below. Fore feet brown, like the upper surface of the body; toes more or less dusky. Hind feet similar, but the toes more dusky. A spot on the outside of the metatarsus lighter than the rest of the foot. A portion of the whiskers dusky, the rest whitish. Nose dusky.

Measurements. (Dry skin No. $\frac{19071}{25863}$, type).—Total length, 148^{mm}; tail, with hairs, 62^{mm}; hind foot, 20.2^{mm}; ear from behind, 4.6^{mm}.*

The skull belonging to the type is badly broken, and it is only possible to give the dimensions of some of its parts.

* These measurements, having been taken from the dry skin, are of course only approximately correct.

Measurements of the skull.—Length of the crowns of the upper series of molar teeth, 5.8^{mm}; lower molars, 5.7^{mm}; length of nasal bone, 6.6^{mm}; breadth of interorbital constriction, 2.8^{mm}.

The molar teeth resemble those of *P. intermedius*, but the lozenges are narrower, and the external re-entrant folds of enamel in the upper molars are directed less backwards and those of the lower molars less forwards than in that species. The molars are rooted. The skull is that of a youngish individual.

HABITAT.—Marshfield, Coos County, Oregon.

Regarding the habits of this mouse, Mr. Todd, in a letter to Professor Langley, writes as follows:

By mail to-day I send you a skin and skull of a tree mouse. It lives exclusively, as far as I have been able to ascertain, among the boughs and branches of the Oregon pine trees (*Abies Douglassi*), making a nest of a size smaller than a robin's nest. It is usually situated on the upper side of a medium-sized branch, perhaps 6 inches in diameter, and is composed of the leaves of the tree deftly split in two from one end to the other and dried. The nest is neatly and rather ingeniously made, and the sameness of the material is a novelty. I have only seen two of these mice—one from Douglas County, and this one from Marshfield, Coos County—though I have seen a large number of their nests in this county (Lane County), as well as in Curry, Coos, and Douglas. I can get no information from any one regarding them either from scientific sources or from the observations of others.

The mouse is almost exclusively arboreal in its habits, but I think that I have reason to believe that they sometimes come to the ground for food, as I have seen tracks in the snow around the trees which I think were made by these little animals. They could be tracked up and down the tree, but to no great distance from it, and were most likely in search of food.

It is entirely distinct from *Arvicola* and every other mouse that I have ever seen. I have lived here for many years, and may, perhaps, be considered a close observer.

NATIONAL MUSEUM, September 10, 1890.

NOTES ON THE HABITS OF THE MOOSE IN THE FAR NORTH OF
BRITISH AMERICA IN 1865.

BY

J. G. LOCKHART.*

The Moose is common over the whole country as far north as the borders of the barren grounds. In the valley of the Yukon, and on the west side of the Rocky Mountains, Moose are particularly numerous, and continue so westward to Bering Strait. There are particular localities, however, where Moose are rarely, if ever, seen. For instance, so far as I have heard, they never approach the shores of Hudson's Bay near York factory. They are very rarely killed in the vicinity of Fort Rae, although they are quite numerous at Big Island and along this side of the lake.

The females have one or two young at a time. They have sometimes, but very rarely, been killed with three young inside; but no one, Indian or white, that I have known, ever saw a female followed by three sucklings or yearlings. For this I have never heard a reason assigned. Since the female has four teats giving milk, one would suppose that she might suckle as many as three young.

The food of the Moose consists of willows, small birch-trees and shrubs, and also of grass and hay. Sometimes two or three will pass an entire winter near certain small lakes or large grassy swamps, in which they feed, scraping off the snow with their feet. In winter, when no water is to be had, they eat snow freely. In winter also the females are most sought after, because they are the fattest. In summer the male is best for the same reason. In fall, when the females are rutting, the males become very emaciated.

There are various modes of hunting the Moose, detailed accounts of which would be, I fear, too tedious. The first and most usual way is to approach the animals on snow-shoes or on foot, as only a hunter

* The manuscript of this paper was received from Mr. Lockhart in 1865, while he was an officer of the Hudson Bay Company, of London, and has been preserved in the archives of the Smithsonian Institution. Between 1860 and 1870 Mr. Lockhart made many valuable contributions to the National Museum, including insects, birds, mammals, and fossils from Mackenzie River, Alaska, Great Slave Lake, and Hudson Bay Territory. For more than thirty years the Hudson Bay Company has zealously co-operated with the Smithsonian Institution in increasing the ethnological and natural-history collections of the National Museum. The objects thus received from Mr. Robert MacFarlane, Mr. Lockhart and other agents of the company have added greatly to our scientific knowledge of British North America.

knows how, and shoot them. The old men who are not able to walk much in deep snow make a kind of fence of three poles tied equidistant from each other, a little taller than a man, stretching perhaps for two days' march between lakes or a lake and a river, or between two mountains, or in any particular place where the Moose are accustomed to pass. Spaces are left vacant here and there in this fence, and in these snares are set. In autumn, during the rutting season, the hunter carries with him the clean, dried shoulder-blade of a Moose, and when he hears the call of the male Moose, which is audible at a distance of several miles, he rubs the shoulder-blade against a small, dry tree and imitates the call of the male. The Moose as soon as he hears the sound imagines, no doubt, that it is another Moose, and runs in the direction, till met by a shot. The male is very dangerous at that season, especially when wounded.

Many years ago, before guns and ammunition found their way into this country, the Indians used to build snow embankments near favorite feeding places, and lie hid there for days until a Moose should chance to pass near, when they would kill him with arrows.

I have been told that they run the Moose with horses in the plain country along the Saskatchewan. So long as the Moose keeps his trot a horse can not catch him, but if he can be forced into a gallop he soon becomes blown, and is then easily overtaken. The hunter uses every precaution, and having approached as near as possible to the animal, unperceived, he mounts, and putting his horse to its utmost speed generally surprises the animal so as to make it break into a gallop.

All Indians in the north have certain superstitious notions regarding the Moose. I have tried hard to prevail upon the Chippewyans to bring me some heads and horns, but without success. The reason for this is that the Indian women during their menses are not permitted to eat or even touch a Moose head, for should they do so they firmly believe that the captor will kill no more that winter. They say that this has been remarked and proved since time immemorial. Now there are many women in the Fort, and they are continually going about from house to house, and, it may be, sitting and driving about on the dogsleds upon which a head would require to be placed if brought from a distance. A head and horns brought to the Fort, cleaned and preserved, would doubtless be visited and handled by women, and if any of them should happen to be in the proscribed state it would finish the hunting success of the Indian who killed the Moose that year. At other times the women, as well as their husbands, handle and eat the heads. The Loucheux of Peel River and the Yukon are strict only with regard to the first Moose an Indian kills after having starved for a period. Of this the women are scarcely allowed to taste, and on no account must they taste the head. These Indians have no objection to part with Moose heads, if assured that no portion, even of the refuse,

will be given to a dog to eat. They can not be prevailed upon to bring young ones to the Fort alive, although many are caught every spring while crossing rivers and lakes. They say that this would spoil their hunting altogether; but why, I could never get one to explain; probably the idea has some connection with the superstitious entertained among the Chippewyans regarding the women.

In spring, when the females are near calving, they proceed to places where they are least likely to be disturbed by wolves, such as islands in lakes and rivers, and also in prairies and large swamps which are overflowed with water at that season; there they search for a dry spot among thick woods where they may bring forth their young. When the calves are very young the mother in their defense will even attack a man. At such times her appearance reminds one forcibly of that of a vicious horse. She raises her head, throws back her ears upon her neck, and sniffs or blows like a horse; then she bounds toward her enemy, striking the ground with her fore feet, her eyes glittering with rage.

When the snow happens to be very deep Moose are run down on snow-shoes and killed with arrows. In spring, when there is a crust, accidents frequently happen in this species of hunting. If the hunter chance, from the nature of the country, to run too near the Moose, after he is fatigued, he will turn like lightning, leap toward his assailant, and trample him under foot. I have known several people who had very narrow escapes of this kind. On one occasion three Indians were hunting and fell upon the tracks of a female Moose and her young one. They immediately gave chase, and in a short time the "Mannisheesh," or young one, became fatigued and stopped. One of the Indians who had left his companions a short distance behind, approached in his haste too near the game. The young Moose instantly leaped towards him. In his eagerness to escape his snow-shoe caught in a willow, and down he went with the Moose on top of him bucking and trampling with all four feet. His companions came up. The Moose again took to flight, and they went to pull out of the snow what they were quite certain would be a mangled corpse, but the man had scarcely received a scratch, so they shook him, and joining in a hearty laugh started again in pursuit.

The Moose down at Peel River and the Yukon are much larger than up this way. There I have known two cases of extraordinary Moose having been killed, the meat alone of each of them weighing about 1,000 pounds. The Loucheux have a superstition that the Indian who meets with one of these extraordinarily large Moose is sure to die within the year, or else meet with some grievous misfortune.

A north wind in winter, when the sun does not rise high above the horizon, affords the best chance for Moose hunting. From some cause which I do not understand, the sun being then towards the south, shining against the wind, causes the tracks to be seen from a considerable

distance. The hunter thus sees from a distance in which direction the Moose has gone and acts accordingly. When the winds come from the east, west, or south, the tracks can rarely be distinguished more than a few yards off, and thus frequently they start the game in an unexpected quarter, without being able to get a shot.

Moose rise and feed at dawn. About sunrise they again lie down to chew the cud or sleep till 10 or 11 o'clock. Then they feed till 2 o'clock in the afternoon, again lie down till 4 or 5 o'clock, then feed till dusk, when they lie down for the night.

They generally lie down with their tails to windward, trusting to their senses of hearing and smelling, which are remarkably acute, to warn them of approaching danger from that quarter; they can use their eyes to warn them from danger to leeward, where hearing, and especially smelling, would be of little use.

While sleeping or chewing the cud their ears are in perpetual motion, one backward, the other forward, alternately. They also have the remarkable instinct to make a short turn and sleep below the wind of their fresh track, so that any one falling thereon and following it up is sure to be heard or smelt before he can get within shooting distance.

OBSERVATIONS ON THE FARALLON RAIL (PORZANA JAMAICENSIS COTURNICULUS Baird).

BY

ROBERT RIDGWAY,

Curator of the Department of Birds.

The type of this species or subspecies, first described in 1874, still remains unique, the ascribed locality (Farallon Islands, near San Francisco) having been repeatedly, but unsuccessfully, scoured for additional specimens by competent collectors, who unanimously assert that no spot suitable for a bird of this family exists on those islands. All that is now known concerning the history of the type specimen (mounted and now in the National Museum collection) is, that it is one of four birds presented to the Smithsonian Institution in 1859 (entered October 13) by Mr. T. C. Martin, the locality given being "Farallones, Cal.", without date or other data. The other birds presented at the same time by Mr. Martin are from various localities, as follows: *Agelaius gubernator*, "S. Francisco;" *Turdus rufopalliatus*, ♂, Tehuantepec, and *Progne chalybea*, ♀, Tehuantepec; the last two collected by Colonel Grayson.

The bird in question was originally described as a variety or geographical race of *Porzana jamaicensis*, and it has been given that rank in the A. O. U. Check List. In his "Birds and Eggs from the Farallon Islands" * Mr. Walter E. Bryant refers to it as follows:

FARALLON RAIL.—Regarding the claim of the unique specimen of this bird as a valid variety, there does not appear to be sufficient grounds for its retention as a separate form. In the light of Mr. Emerson's investigations, and that of others who have visited the islands and found no rails or suitable places for them to live, there seems to be but one conclusion to draw concerning it, and that is that it is an abnormal specimen of *P. jamaicensis*.

Whatever doubt there may be, however, of the present occurrence of the bird on the Farallons, or even of the type specimen having really been obtained there, there can not, I think, be any question as to its distinctness from *P. jamaicensis*. That it is not an "abnormal specimen" of the latter is almost certain, from the fact that specimens of *P. jamaicensis* from the mainland of California do not, apparently, present any differences either of size or coloration from those from the Atlantic States, the West Indies, or Chili, notwithstanding numerous examples have been compared. The possibility of its identity with a little-known species inhabiting the Galapagos Islands has, however,

*Proceedings of the California Academy of Sciences, 2d ser., vol. 1, 1888, pp. 25-50.

recently occurred to me, though unfortunately I am unable, from lack of specimens, to settle the matter. In the "Zoölogy of the Beagle" (1841), Mr. John Gould described a *Zapornia spilonota* from a specimen obtained on James Island, Galapagos, by Mr. Darwin, the description being accompanied by a colored figure (plate 49). This description and colored figure agree closely in certain characters with the Farallon Rail, the back being without white spots, and those of the wings and posterior under parts much smaller and less numerous than in *P. jamaicensis*. Additional specimens were obtained in 1868 on Indefatigable Island, by Dr. Habel, these being mentioned by Mr. Salvin in his important paper "On the Avifauna of the Galapagos Archipelago" (Transactions of the Zoölogical Society of London, vol. ix, pt. ix, 1876, pp. 447-510, pls. 84-89).

The descriptions given by Messrs. Gould and Salvin, respectively, differ considerably, especially as to the color of the upper parts. Mr. Gould's is as follows:

Head and all the under surface blackish-gray; *all the upper surface dark reddish brown*, fading off on the rump into deep grayish-black, the wings, hinder part of flanks, and under tail-coverts slightly sprinkled with white; bill blackish-brown; feet, reddish; iris, bright scarlet.

Mr. Salvin's description (translated from the Latin) is as follows:

♂ (Indefatigable Island) blackish-cinereous, nearly uniform, the back and outer surface of the wings washed with oily rufous; the lower flanks and under tail-coverts obsoletely spotted with white, the wings externally, back posteriorly, and rump sometimes marked in the same way; iris scarlet; feet olive-brown; bill black. * * *

Obs.—Species similar to *P. jamaicensis*, but with the nape entirely blackish-cinereous and the dorsal spots almost obsolete; allied to *P. tabuensis* so far as colors are concerned, but to be distinguished at the first glance by the short tail.

Regarding individual variations, Mr. Darwin says that "with respect to the specific description I must observe that in one of the specimens the small white spots on the wings and abdomen are wanting. This is not a sexual distinction, but possibly may be owing to immaturity." Mr. Salvin also says that "a specimen in Dr. Habel's collection has no spots on the wings and lower back, but does not otherwise differ from the rest of his examples." He adds that "these spots are somewhat variable, being well defined in some, obsolete in others, and entirely wanting in a few;" and that "in none are they so well developed as in *P. jamaicensis*, the nearest ally of the present bird."

Unfortunately I have not been able to compare specimens of *P. spilonota* with the type of *P. jamaicensis coturniculus*, but the descriptions and plate referred to above show that the two are very closely related—much more closely, indeed, than either of them is to *P. jamaicensis*. Points in which they agree and at the same time differ from *P. jamaicensis* consist mainly in the restriction, both as to size and the surface which they cover, of the white spots on the wings and posterior under parts, these markings always covering the back in *P. jamaicensis*, while

in *P. spilonota* and *P. jamaicensis coturniculus* the back is entirely unspotted.

The type specimen of the Farallon Rail is probably in autumnal or immature plumage, which in *P. jamaicensis* differs from that of the fully adult bird in spring in having the chin and throat dull whitish, instead of deep slate-gray, like the breast and belly. The plate of *P. spilonota* in the "Zoölogy of the Beagle" represents a bird in full plumage, the chin and throat being concolor with the other lower parts, but doubtless younger birds of this species also have the chin and throat whitish.

Except in the color of the chin and throat and the larger dimensions, there is nothing in the original description of *P. spilonota* that would not exactly fit *P. jamaicensis coturniculus*; but Mr. Salvin's description, taken from examples from a different island (Indefatigable), will not apply in one particular, namely, in the color of the nape, which is said to be entirely blackish cinereous, whereas in *P. jamaicensis coturniculus* the entire hind-neck is exactly the same deep brown color as in *P. jamaicensis*.

As stated above, I have been unable to examine specimens of *P. spilonota*; but I think there can be no doubt that the Farallon bird is decidedly more closely allied to that of the Galapagos than to the widely-distributed continental species, Californian (mainland) examples of which appear to be exactly like those of the Eastern United States, the West Indies, and Chili.* In view of these facts, the technical name of the Farallon Rail should be changed by the elimination of the middle term, leaving it to stand as *Porzana coturniculus* (Baird) until its relationship to *P. spilonota* can be more definitely ascertained.

Recent explorations have considerably increased the number of species of water birds common to the Galapagos and California (or Lower California), *Sula gossi* (Galapagos to Lower California) and *Pelecanus californicus* (Galapagos to Oregon) being among the number, while *Hæmatopus galapagensis* and *H. frazari* (of Lower California) are hardly separable. May not, therefore, this puzzling rail, of which it seems to be impossible to obtain a second example, prove to be a straggler of another Galapagoan species? Or, as an alternative possibility, might it not have been a straggler from one of the more southern Californian islands, of the Santa Barbara group? This question brings to mind the case of the Swallow-tailed Gull (*Creagrus furcatus*), the original specimen of which is said to have been obtained at Monterey, California, while no example has subsequently been taken north of the Galapagos Islands, the only certainly known breeding-ground of the species. It is known that localities of the specimens obtained by the *Venus* expedition were more or less mixed in the process of labeling; still, in view of what we now know of the distribution of water birds along the Pacific coast of America, the correctness of the alleged locality of the original *C. furcatus* does not seem so very improbable.

* See Water Birds of North America, Vol. I, p. 378.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COMMISSION STEAMER ALBATROSS.

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No. XVIII.—LIST OF FISHES OBTAINED IN THE HARBOR OF BAHIA, BRAZIL, AND IN ADJACENT WATERS.

BY

DAVID STARR JORDAN,
President of the University of Indiana.

In the winter and spring of 1887 and 1888, the steamer *Albatross* made a cruise from Norfolk, Va., to San Francisco in the service of the U. S. Fish Commission. The collection made at this time in the harbor of Bahia and a small collection made in deep water off Cape San Matias in northeastern Patagonia form the subject of the present paper.

The collection from Bahia includes one hundred and twelve species. As the number of specimens taken does not exceed two hundred it is evident that the results which would have come from extensive collecting might have been exceedingly valuable.

The following is an annotated list of the species obtained :

GALEORHINIDÆ.

1. *Scoliodon terræ-novæ* (Richardson).

One specimen. *Scoliodon lalandi* is the same species.

SPHYRNIDÆ.

2. *Sphyrna tiburo* (L).

One specimen.

RHINOBATIDÆ.

3. *Rhinobatus electricus* (Bloch & Schneider).

One specimen. Cartilages very narrow; snout long; upper parts with bluish white spots of the size of the pupil. This is *Rhinobatus undulatus* Olfers, but the misleading name, *electricus*, is much older.

AËTOBATIDÆ.

4. *Stoasodon narinari* (Euphrasen)

One head preserved.

ALBOLIDÆ.

5. *Albula vulpes* (L).

Common.

CLUPEIDÆ.

6. *Harengula humeralis* (Cuv. & Val.).

Several specimens.

7. *Opisthonema oglinum* (Le Sueur).

Several specimens.

STOLEPHORIDÆ.

8. *Stolephorus browni* (Gmelin).

Common.

9. *Lycengraulis grossidens* (Cuv. & Val.).

One specimen. This species is well described by Dr Günther.

SYNODONTIDÆ.

10. *Synodus fœtens* (L.)

Several specimens. Scales 59–60; anal 12. These specimens evidently correspond to the *ruber* of Lacépède, the *spixianus* of Poey, and the *longirostris* of Agassiz. They agree fully with Cuban specimens, but the latter have more sharply defined coloration. I see no difference between these Brazilian specimens and *Synodus fœtens* from South Carolina. The dorsal in all has the first long ray about reaching tip of last ray when depressed. The specimen of *fœtens* measured by Professor Meek had the dorsal mutilated and on this character chiefly he recognizes *spixianus* as a distinct species.

11. *Trachinocephalus myops* (Forster).

Several specimens. Light brown; three or more lengthwise stripes of yellowish alternating with brown, the upper stripe just above lateral line and edged with darker; a whitish streak along lateral line; about six diffuse brown cross-blotches on side of back, these ceasing just below lateral line; a brown band along sides above uppermost yellowish streak, the back above this mottled and cross-blotched. A large black scapular blotch. Fins nearly plain. Top of head vermiculated with darker. A dark brown band from eye across lower jaw. Snout very short, shorter than eye; teeth slender, smaller and closer set than in *Synodus*. Pectoral very short, not quite 2 in head, but scarcely reaching beyond front of ventrals which are very long—as long as head—and reaching vent, and are also farther forward than in *Synodus*. Anal unusually large, $1\frac{1}{4}$ in head, $1\frac{1}{3}$ to $1\frac{1}{4}$ times dorsal, and of 15 rays. Dorsal also longer than usual, of about 11 rays. Anal $4\frac{2}{3}$ in body; (anal $7\frac{3}{4}$ in *Synodus*.) Vent at tip of last dorsal ray in *Trachinocephalus*. It is far behind dorsal, nearer adipose fin in *Synodus*.

Trachinocephalus is much stouter than *Synodus*, with short, blunt, compressed head. In *Synodus*, the head is depressed, with flat triangular snout; smaller scales. These two groups may vary into each

other, but in view of the difference in the place of the vent they may be considered as separate genera. The vent is very slightly nearer base of caudal than the axil of the pectoral in *Trachrinocephalus*. In *Synodus*, the vent is much nearer base of caudal than base of ventrals.

This must be *Synodus brevirostris* Poey, said to have 10 anal rays and ventral under middle of pectoral. In most other respects Poey's description agrees, and is doubtless the same species.

EXOCETIDÆ.

12. *Tylosurus subtruncatus* (Poey).

One specimen, agreeing entirely with those from Cuba. This is probably the *Timucu* of Maregrave, but not the *Belone timucu* of Cuv. & Val.

13. *Hemiramphus pleii* (Cuv. & Val.).

Scales 53; ventrals midway between base of caudal and middle of pectorals. This species is probably identical with *Hemiramphus brasiliensis*. The latter name is the older.

14. *Hemiramphus unifasciatus* Ranzani.

Numerous young specimens.

MURÆNIDÆ.

15. *Gymnothorax moringa* (Cuvier).

One adult.

16. *Gymnothorax funebris* (Ranzani).

Adult and young.

17. *Gymnothorax vicinus* (Castelnau).

One adult. This is probably *Murænophis vicina* of Castelnau, but probably not his *M. camaruru*. The specimen from Cuba called by me elsewhere *Sidera vicina* is probably also different. I can not distinguish the *Muræna maculipinnis* of Kaup from this species. Brown, mottled with darker brown; angle of mouth dusky; dorsal edged with dusky, anal with whitish; dorsal mottled like the body; no black spot at gill opening; eye, 2 in snout; mouth, $2\frac{1}{4}$ in head; tail longer than body; jaws closing completely; maxillary teeth in one row; head $1\frac{9}{10}$ in trunk.

CONGRIDÆ.

18. *Murænesox savanna* (Cuvier).

Brown above, silvery below; dorsal and anal edged with black; pectoral with black tip; dorsal beginning just before pectoral; pectoral as long as maxillary, $2\frac{1}{4}$ in head. Eye, $2\frac{1}{2}$ in snout; edges, $4\frac{1}{2}$ in head.

Teeth not lobed, but the surface uneven. This is evidently *Conger limbatus* Castelnau.

SYNGNATHIDÆ.

19. *Siphostoma crinitum* (Jenyns).

Three specimens. Dorsal about 20; dorsal rings 1 + 4 to 1 + 5. Body rings, 17 + 34 to 36. Lateral line passing into lower part of tail. The three specimens are differently colored; one female is black, darkest below, with ten cross-bands of white, each with dark before it. Another female is gray, belly black; ten pairs of black cross-bars with whitish between them. Lateral line, opercle, and a bar across the eye, black. The male is wholly different, dark brown, with twenty-two cross-bars sharply defined but unequal; additional white spots on belly, roundish white spots and other irregularities breaking up some of the bands. Snout mostly white, top of head mesially dark; dark on opercle and below eye; white marks around the dark on top of head. Snout very short, turned up, shorter than postorbital. Top of head and supercilium crested, more so in the female. A median ridge on top of snout, more distinct and serrate in the female, entire in the male. Edge of plates more distinct than in the female. A ridge the whole length of opercle in both sexes. Female with slender black filament over the eye. Head, 3 in trunk; trunk, 2 in tail. *Siphostoma crinigerum* of Bean is closely allied, but the snout notably longer and slenderer; caudal longer. *Siphostoma zatropis* is also similar, but its caudal rings are much fewer. The name *Siphostoma albirostre* (Kaup) should probably supersede *zatropis*. *Corythoichthys vittatus* of Kaup is probably the male of *Siphostoma crinitum*.

FISTULARIIDÆ.

20. *Fistularia tabaccaria* (L.).

One specimen. Body above with numerous round bluish spots. This is *Aulostoma marcgravei* of Castelnau.

MUGILIDÆ.

21. *Mugil gaimardianus* (Desmarest).

Scales, 36. Soft dorsal black on its lobe; no black at base of pectoral; caudal edged with dark; teeth very small; distance from top of pectoral to dorsal one-third length of pectoral, not one-sixth as in Cuban examples, which we refer to the same species.

22. *Querimana curvidens* (Cuv. & Val.).

Eleven specimens, the largest $2\frac{1}{2}$ inches. Blue, paler below; axil dusky. Lips larger than in *Mugil*. Ciliiform teeth quite large, those in lower jaw turned downwards and outwards all around the jaws, those in upper jaw larger, normally placed. Head $3\frac{2}{5}$; depth $3\frac{2}{5}$. Anal II, 9, scaly. Scales 36. Pectoral short, not reaching dorsal.

SPHYRÆNIDÆ.

23. *Sphyræna picudilla* Poey.

One specimen. First dorsal opposite ventrals, and much behind pectoral. Scales, 115.

POLYNEMIDÆ.

24. *Polydactylus virginicus* (L).

Filaments, 7; teeth in a narrow band; scales, 57; anal, II, 14 or 15; pectorals and tips of both dorsals black. I can not distinguish this from Cuban specimens, nor can I separate *Polynemus oligodon* from it.

SCOMBRIDÆ.

25. *Scomberomorus maculatus* (Mitchell).

One specimen.

CARANOIDÆ.

26. *Decapterus punctatus* (Agassiz).27. *Trachurops crumenophthalmus* (Bloch).28. *Caranx latus* (Agassiz).29. *Selene vomer* (L).30. *Chloroscombrus chrysurus* (L).

PEMPHERIDÆ.

31. *Pempheris schomburgki* (Müller & Troschel).

Dorsal 13; anal III, 31. Scales 56 to 60; eye two-thirds in head; head $3\frac{2}{5}$ in length; depth $2\frac{2}{5}$; base of anal $2\frac{1}{4}$ in body, $1\frac{2}{3}$ times as long as head. The anal fin is therefore much longer than in *Pempheris poeyi*. Color red, silvery below, dusky on back and the longest base of anal. This agrees fully with Steindachner's account of this species, and it corresponds exactly with Cuban specimens of *Pempheris mülleri* of Poey.

PRIACANTHIDÆ.

32. *Priacanthus cepedianus* (Desmarest).

Dorsal x, 13; anal III, 14; dorsal and anal spotted. These young specimens agree fairly with the account given by Mr. Morrison. (Proc. Ac. Nat. Sci., Phila., 1889, 161.) They are evidently of the same species as are the Cuban examples.

33. *Priacanthus catalufa* Poey.

One large specimen. Body oblong, less deep than in the preceding; unmarked, silvery red; anal, soft dorsal, and caudal edged with black; no spots on dorsal; posterior half of ventral black. Eye very large; ventral reaching anal spine. Posterior nostrils in a single oblong

opening within which is a septum considerably below the surface. Preopercular and opercular spines almost obsolete. Eye, $2\frac{1}{5}$ in head; ventral nineteen-twentieths of head. Dorsal spines more or less granulate on the edge. Tail slim; caudal lunate. Scales about 93. Twenty-one gill-rakers below angle. Pectoral, 2 in head.

HOLOCENTRIDÆ.

34. *Holocentrus adscensionis* (Osbeck).

Several specimens. The Brazilian specimens differ somewhat from those from Cuba, and the latter should be regarded as a distinct variety (*Holocentrus sogo* Bloch). The Brazilian form (var. *adscensionis*, or *pentacanthus*) has the preopercular spine not reaching past the gill opening, its free portion $2\frac{1}{3}$ in eye. Pectoral short, $1\frac{5}{6}$ in head, measured to end of opercular spine; ventrals reaching vent. Third anal spine measured from the scales, $2\frac{1}{6}$ in head. Soft dorsal, $1\frac{1}{2}$ in head; caudal lobe not quite equal to head. In var. *sogo* the preopercular spine reaches about to root of pectoral, its free part $1\frac{1}{2}$ in eye. Pectoral, $1\frac{3}{4}$ in head; ventrals nearly or quite to vent. Third anal spine, $1\frac{9}{10}$ in head; soft dorsal one-tenth longer than head; caudal lobe about one-eighth longer. The color and form seem to be the same in both forms.

35. *Myripristis jacobus* (Cuv. & Val).

Several specimens. They are exactly like others from Cuba, and are therefore identical with *M. lychnus* of Poey.

CENTROPOMIDÆ.

*36. *Centropomus undecimalis* (Bloch).

Three specimens.

SERRANIDÆ.

37. *Rypticus saponaceus* (Bloch & Schneider).

One specimen, young. Spines, 3; dorsals separate; depth, $3\frac{1}{2}$ in length; 16 scales between lateral line and dorsal; pectoral, $1\frac{1}{2}$ in head; body faintly mottled; fins dark edged; a dusky blotch behind eye. Adult specimens from Florida have the body deeper, the depth $3\frac{1}{4}$; pectoral, $1\frac{1}{3}$ in head, and the dorsal continuous.

The specimen from Bahia is probably the young of the same species, and is identical with the young specimens sent from Havana by Poey. Castelnau calls this species *Rypticus microps*, crediting this name to Broussonet, but I have not found it in print.

38. *Mycteroperca falcata* (Poey).

Scales, 125; 16 gill-rakers on lower half of arch; anal slightly produced; caudal, lunate.

39. *Epinephelus adscensionis* (Osbeck).

One specimen.

40. *Epinephelus morio* (Cuv. & Val.).

One specimen.

41. *Alphestes afer* (Bloch).

Three specimens, similar to those from Cuba.

42. *Bodianus fulvus* (L.).

One specimen of the brown variety *punctatus*.

LUTIANIDÆ.

43. *Rhomboplites aurorubens* (Cuv. & Val.).

One specimen.

44. *Ocyurus chrysurus* (Bloch).45. *Lutjanus jocu* (Bloch & Schneider).46. *Lutjanus caxis* (Bloch & Schneider).47. *Lutjanus analis* (Cuv. & Val.).48. *Lutjanus synagris* (L.).

HÆMULIDÆ

49. *Hæmulon plumieri* (Lacépède).50. *Hæmulon parra* (Desmarest).51. *Hæmulon carbonarium* (Poey).52. *Hæmulon schranki* (Agassiz).53. *Hæmulon aurolineatum* (Cuv. & Val.).54. *Anisotremus virginicus* (L.).55. *Anisotremus bicolor* (Castelnau).

One specimen. This species is very well figured by Castelnau.

Gray; a black median line on back; five equidistant black stripes as wide as interspaces on side, straight and horizontal, the first ending under ninth dorsal spine, the second under middle of soft dorsal, the third running from upper edge of gill opening to last dorsal ray, with two black spots behind it on back of tail, the fourth on axis of body, ceasing on caudal peduncle, with a round black spot behind it at base of caudal as large as pupil; fifth stripe very obscure, with a trace of a sixth one; a black blotch at base of anal, not on the fin; a large black blotch nearly as large as pupil on opercular flap; two silvery stripes horizontal on the dusky shade of cheeks; fins plain grayish, the ventrals black, the anal dusky, axil dusky. Scales above lateral line in series not parallel with the lateral line; 6-7 scales in a vertical series below lateral

line. Pectoral sharp; $1\frac{1}{5}$ in head, not quite to anal. Second anal spine very strong; $2\frac{1}{10}$ in head, equal to longest dorsal spine. Eye large; 3 in head. Snout short; rather blunt. Profile steep. Dorsal XII, 16; anal III, 8. Scales 53.

56. *Anisotremus bilineatus* (Cuv. & Val.).

This species is very similar to the preceding in form and scales. The color is different. Adult gray, with the dark spot at the base of each scale on anterior part of back. Fins all dark, no distinct opercular spot.

Anisotremus interruptus (Gill) = *Pristipoma furthi* Steindachner, of the west coast of Mexico, is very similar, but seems to differ in the steeper, straighter profile, and the larger size of the scales on the back.

57. *Genyatremus cavifrons* (Cuv. & Val.).

Several specimens.

SPARIDÆ.

58. *Calamus penna* (Cuv. & Val.).

(*Pagellus milneri* Goode & Bean.) Two examples apparently belonging to this species. Black axillary spots distinct.

59. *Archosargus unimaculatus* (Bloch).

One specimen belonging to the typical form of this species (var. *unimaculatus*) as described by Eigenmann and Hughes.

APOGONIDÆ.

60. *Apogon maculatus* (Poey).

The specimen obtained agrees with others from Pensacola, but is larger in size; the black spot under soft dorsal and the one on upper part of caudal peduncle larger and more diffuse than in Pensacola examples, and the black blotch on opercle less distinct. The dark punctulations on cheek are close together, forming a dusky blotch. Outer ridge of preopercle finely but evidently serrate, the inner entire.

61. *Apogon americanus* Castelnau.

This species was originally described and well figured by Castelnau from a specimen taken at Bahia. It has not been certainly recognized by later authors. Vaillant & Bocourt have identified it with the Pacific coast species, *Apogon dovii*, while Professor Cope has referred to it a specimen obtained by him from the Gulf Stream off Newport, R. I. According to Prof. S. E. Meek this Newport specimen belongs to the European species, *Apogon imberbis* L. It is probable that the identification of *A. americanus* with *A. dovii* is also incorrect.

Our specimen from Bahia, in excellent condition, shows the following characters:

Head equal to depth of body, $2\frac{1}{5}$ in length, maxillary $1\frac{2}{3}$ in head, eye $2\frac{1}{3}$. Gill-rakers slender and long, about 8+10 in number. Scales 2-25-9. D. VI-1, 8; A. II, 8. Preopercle very finely serrate above, mostly entire below, except near the angle, when its surface is irregularly notched. Color red, unmarked, except for a diffuse dusky blotch made up of dark points on the opercle, and some dark points on snout and cheeks. No spot at base of caudal, and no spot or marking anywhere on body or fins, except the dusty blotch on head.

MULLIDÆ.

62. *Upeneus maculatus* (Bloch).

Numerous specimens, large and small, the latter with the characteristic markings very obscure.

63. *Upeneus martinicus* Cuv. & Val.

A single young example. It is well distinguished from the young of *U. maculatus* by its smaller scales (37), larger eye, shorter snout, smaller mouth, smaller teeth, and shorter barbels. *Upeneus parvus* Poey, with the caudal banded, must be a different species. *U. martinicus* Cuv. & Val., and *U. balteatus* Cuv. & Val., are evidently the young of the species called by Poey *Upeneus flavovittatus*.

SCIÆNIDÆ.

64. *Odontoscion dentex* (Cuv. & Val.).

One large specimen.

65. *Bairdiella ronchus* (Cuv. & Val.).

Two specimens.

66. *Micropogon furnieri* (Desmarest).

One example.

67. *Eques acuminatus* (Bloch & Schneider).

One specimen, with the usual pale stripes, but obscurely marked.

GERRIDÆ.

68. *Gerres brasiliensis* Cuv. & Val.

One specimen. Eye 3 in head; second dorsal spine about $1\frac{2}{5}$; second anal spine $1\frac{1}{3}$, as long as third but stouter, $4\frac{2}{5}$ in body. Ventrals not black, but peppered with dark points, as are the soft rays of dorsal and anal. Pectoral a little longer than head, 3 in body, not quite reaching vent. General coloration similar to that of *G. plumieri*, the stripes a little less pronounced; the back also much less elevated, and the spines

lower. It agrees fairly with Cuban specimens (*Gerres patao* Poey), but has the second anal spine lower and the ventrals paler. Probably all belong to one species.

69. *Gerres rhombeus* Cuv. & Val.

Anal spines, two; premaxillary groove naked.

70. *Gerres olisthostoma* (Goode & Bean).

Several, constantly with anal spines three and the premaxillary groove scaled.

71. *Gerres pseudogula* (Poey). (*Gerres jonesi* Günther.)

Several specimens.

EPHIPPIDÆ.

72. *Chætodipterus faber* (L.).

Young specimens.

CHÆTODONTIDÆ.

73. *Chætodon striatus* (L.).

Several, agreeing well with Günther's description.

74. *Pomacanthus aureus* (Bloch).

Several specimens, adult and young, agreeing well with the account given by Eigenmann, Ann. N. Y. Acad., 1887. In the adult, the caudal is pale at base and tip, the dorsal has a narrow pale edge behind; each large scale has a dark spot; there is no pale stripe before eye, and the space behind preopercular spine is pale. One specimen is from the Abrolhos Islands.

75. *Pomacanthus arcuatus* (Linnæus).

One adult. This species is well distinguished from the preceding at all ages by the smaller scales and by the presence of ten dorsal spines instead of nine. The adults of the two are also different in color. In *P. arcuatus* each scale has a whitish crescent; there is a white stripe from eye to nostril; the caudal and dorsal are without pale edge, and there is no pale area behind preopercular spine. In both species, the young show pale cross bands, and of these the one behind the shoulder persists longest.

76. *Holacanthus ciliaris* (L.).

Several, of different ages.

77. *Holacanthus bicolor* (Bloch).

Several specimens.

ACANTHURIDÆ.

78. *Acanthurus cœruleus* (Bloch).

One large specimen. Deep blue, with wavy, pale blue horizontal lines on side of body; fins blue; anal with dark longitudinal streaks; pectoral yellow; edge of caudal black. Caudal lunate.

79. *Acanthurus hepatus* (Linnaeus).

One adult. Very dark; sides with narrow black cross-bars; fins almost black. Caudal slightly lunate, the lobes subequal.

80. *Acanthurus bahianus* Castelnau. (*Acanthurus tractus* Poey).

Three specimens. Identical with Cuban examples and evidently belonging to the species tolerably figured by Castelnau as *Acanthurus bahianus*.

This species is easily distinguished from *A. hepatus* by the forked or deeply lunate caudal, the upper lobe of which is much the longer and falcate, often filamentous at tip. In this species both dorsals are marked with about eight dark lines parallel with the margin of the fin. The general color is brown, paler than in *A. hepatus*, and blotched with paler below.

POMACENTRIDÆ.

81. *Pomacentrus fuscus* Cuv. and Val. (*Pomacentrus variabilis* Castelnau.)

The numerous specimens of this species from Bahia and the Abrolhos differ much among themselves in coloration, these differences apparently corresponding to different stages in growth.

The larger specimens, corresponding to the types of *fuscus*, are nearly black, with a few blue points on the head and a black axillary spot; the fins all black; no spot at base of last ray of anal.

Other smaller specimens are dark yellowish olive, the fins black, a black axillary spot; base of dorsal dark, but without spot; blue points on head; no dot on last ray of anal.

A still smaller one, $2\frac{1}{5}$ inches long, is black, with the fins dark; blue points on head; a black spot on base of pectoral; a large black spot on soft dorsal, surrounded by blue points. A similar but smaller ocellus, bordered with blue on the back of tail. A white spot at base of last ray of anal.

All these specimens I refer to *Pomacentrus fuscus*, and these variations in color correspond to those in the very similar Pacific coast species, *Pomacentrus rectifrænum*. The species called *bairdi*, *analigutta*, and *flavilatus* seem to be, as Günther has indicated, stages in the growth of *P. rectifrænum*.

A study of this species has led me to recompare the specimens collected by me at Pensacola and identified as *leucostictus* and *obscuratus*.

Specimens from Key West belonging to *leucostictus* are slenderer than the young of *fuscus*, the blue dots on head forming stripes on head and on side of snout; the dorsal ocellus is higher on the fin; there is no ocellus on the caudal peduncle; the pectoral is shorter than in *P. caudalis*. A white spot on base of last ray of anal. *Pomacentrus atrocyaneus* and *analis* of Poey seem to be identical with *P. leucostictus*.

The specimens from Key West, identified as the male of *obscuratus*, are probably adults of *leucostictus*, from which they differ in darker color and greater depth.

Those called the female of *obscuratus* are probably different from *leucostictus* and are *Pomacentrus obscuratus*. In these the profile of the head is very blunt and convex in every direction. The color is very dark and there is no spot except a few blue ones on the head and sides and a dark shade on the base of the pectoral. The body is deeper than in the adult of *fuscus* (depth, $2\frac{1}{4}$ in length in *fuscus*; 2 in *obscuratus*).

82. *Pomacentrus caudalis* Poey.

One of the specimens from Bahia corresponds with Poey's *caudalis* and probably does not belong to *Pomacentrus fuscus*. It is very slightly more elongate, its coloration is largely yellow, the fins not black; blue points on head, base of caudal, and anal; axil dark; a black blotch on dorsal and one on back of caudal peduncle larger than in the young of *fuscus* and less ocellate. The forehead is less decurved, and there is a white dot at base of last anal ray. Perhaps *caudalis* also is one of the protean forms assumed by *fuscus*, and it may be that the *Pomacentrus pictus* of Castelnau, brown, with the caudal mostly yellow, is one of the forms of the same fish.

83. *Chromis marginatus* (Castelnau).

Several specimens. Dorsal spines, 12; scales, 3-30-10; gill-rakers numerous, long, and slender; pectoral a little longer than head, not quite reaching anal; upper lobe of caudal longest, the fins deeply forked; color, bluish olive, a black spot within axil and on base of pectoral; dorsal black, except the last rays; each lobe of the pointed caudal black, the middle of the fin pale; traces of three lengthwise stripes of yellow on the body.

This species is close to *Furcaria cyanea* Poey, but this species has blue spots on the scales. The Pacific coast species, *Chromis atrilobatus* Gill, is quite distinct from *marginatus*.

84. *Glyphisodon saxatilis* (L.).

Young specimens,

LABRIDÆ.

85. *Harpe rufa* (L.).

One specimen.

86. *Halichæres dimidiatus* (Agassiz). (*Julis internasalis* Poey.)

These specimens agree well with those from Cuba described in Proc. U. S. Nat. Mus., 1886, 62. The blue band from eye to nape is broader behind and it is edged everywhere by deeper blue. This species is probably the *Labrus cyanocephalus* of Bloch, as Castelnau has suggested, but the figure is too poor to permit identification.

All the American species of *Halichæres* agree in having the anterior canines $\frac{3}{4}$. Most of the East Indian species of this group have the canines $\frac{3}{2}$ and none of them $\frac{2}{4}$. This character might be taken to define a subgenus or genus containing all the American species, hitherto referred to, *PlatyGLOSSUS*, *Chærojulis* or *Halichæres*. The name *Ichthy-callus* was applied by Swainson to a number of species of *Julidinae*, distinguished from the others by fallacious or imaginary characters. As, however, *H. dimidiatus* is the species first named by Swainson, it may be taken as the type of *Ichthy-callus*, and the name may be used to designate these *Halichæres* with the teeth $\frac{2}{4}$. These are *radiatus*, *nicholsi*, *sellifer*, *dimidiatus*, *garnoti*, *maculipinna*, *bivittatus*, *dispilus*, *poeyi*, and *caudalis*.

87. *Halichæres poeyi* (Steindachner). (*Julis crotaphus* C. & V., not of Cuvier.)

Three specimens. This species is probably distinct from the one which I have heretofore called *Halichæres* or *PlatyGLOSSUS caudalis*. The form of the caudal fin is the same and both have the black spot behind the eye. *H. poeyi* is, however, deeper in body, and the snout is decidedly less acute. Depth, 4 in length; snout, $2\frac{3}{4}$ in depth of body.

In spirits, *H. poeyi* is pale, with traces of three dark cross-shades with paler interspaces; some traces of blue spots on scales; a blue streak forward from eye; a dark blue spot behind eye; above this a golden spot, very distinct in two specimens but obsolete in the larger one. Base of pectoral, bluish; an ink-like spot at base of last dorsal ray. No marks evident on the fins.

These specimens agree fairly with Steindachner's account of *Platy-glossus poeyi* (Ichth. Notiz, VI, 49, 1867), except that the eye is larger. Steindachner says, "Das Auge ist klein, $6\frac{1}{2}$ mal in der Kopflänge, mit Einschluss des häutigen Lappens * * * die Schnauzenlänge bis zum Oberlippenrand fast drei Augenlängen." In our examples the snout is barely twice as long as the eye.

88. *Xyrichthys splendens* Castelnau. (*Xyrichthys argentimaculatus* Steindachner.)

Two adult, one young example, one of the adults being from near Cape San Roque (station 2759, 7° S., 34° 47' W.). The figure given by Castelnau is fairly correct, especially as regards form of the body. This is a deep, compressed species, with a bluntish, evenly rounded profile, which is scarcely trenchant, the species being therefore intermediate between the typical *Xyrichthys* and *Novaculichthys*. Eye, $1\frac{2}{5}$ in width of

preorbital, not placed so high as in *Xyrichthys novacula*; preorbital $3\frac{1}{2}$ in head; depth of body, 3 in length; ventrals, 3 in body, produced in long streamers which extend past first third of anal; dorsal and anal each ending in a sharp point behind; caudal rounded, first two dorsal spines a little shorter and a little less pungent than the rest, but very similar to them; lateral line on second full row of scales, $1\frac{1}{2}$ rows above it, the half row forming the dorsal sheath; scales, 28.

Color now faded, probably red, with blue spots on scales; a large squarish silvery blotch on middle of side of body, as large as cheek and preopercle; within this silvery area is a diamond-shaped spot of jet black, nearly covering a scale; sometimes a smaller spot below this. Head with ten vertical bars of dark blue, the interspaces yellowish; a pale streak along each side of snout, close to and parallel with edge of profile; dorsal with cross-streaks of light blue; anal with blue, with longitudinal streaks of paler and darker; caudal cross-banded with darker; a few small scales below eye.

A younger specimen is bluer and has the ventral streamers shorter; little longer than head.

A very young example has the ventrals extending little past front of anal. In this the silvery area is obsolete, and the black lateral spot very faint; no stripes on head. The first two dorsal spines are elevated and flexible; caudal cross banded with dark; dorsal and anal with oblique dark cross-streaks; back with very faint cross bars. This specimen approaches very closely to *Xyrichthys rosipes* from Key West, and suggests that the types of this species must be the young of some ally of *Xyrichthys splendens*, possibly of *Xyrichthys ventralis* Bean. We find in fact no difference between *X. rosipes* and the young of *X. splendens*, except that in the former the first two dorsal spines are a little higher and the caudal fin not banded.

89. *Xyrichthys uniozellatus* Agassiz.

Form much as in *X. novacula*, the head sharp-edged, and the preorbital very high. Eye $2\frac{1}{2}$ in preorbital, which is $2\frac{1}{4}$ in head; depth, $3\frac{1}{4}$ in body. Ventrals, $1\frac{3}{5}$ in head, their filamentous tips reaching vent. Soft dorsal and anal pointed behind; dorsal spines pungent, the two anterior shorter and not sharp.

In alcohol very pale, perhaps once bright red; a blue vertical spot on each scale; head with twelve blue bars. A black ink-like ocellus bordered with blue at seventh dorsal spine; a very obscure dusky cross-band on body below it. No other marks evident.

90. *Sparisoma frondosum* (Cuvier). (? *Sparus distinctus*, *circumnotatus* and *emarginatus* Poey.)

One adult; one young specimen, probably belonging to the species called *frondosum* by Cuvier, Agassiz. and Günther. Three of the nominal species of Poey may belong here.

Allied to *Sparisoma flavesceus*; the dentition the same. No posterior canines. Three scales on cheek. Caudal lunate, the angles short but sharp; depth of body 3 in length.

Mottled olive-brown; a faint pale streak along lateral line; three or four similar ones below it, the interval brown and mottled; a very faint pale blotch on back of tail with a dark brown blotch before and behind it; three other dark blotches below dorsal; all these markings obscure and diffuse. Dorsal mottled everywhere; caudal with dark cross-bars and pale spots, more sharply marked than in *S. flavesceus*, its posterior margin abruptly whitish; anal pale, mottled, and with four oblique cross-bars of darker; pectoral pale, with paler mottlings, its axil pale brown, this mark much less distinct than the axillary spot in *flavesceus*; chin and snout dark; a pale band across chin; the most sharply defined dark markings those on upper and lower edge of caudal and its peduncle.

The young specimen has many dark points on the head and a dark opercular blotch. The whitish edge to the caudal is conspicuous, and the pale streaks along the side.

I have examined one of the specimens of *S. distinctum* sent by Poey to the National Museum. It seems to be specifically identical with the species here described, but there is a distinct posterior canine on each side.

91. *Sparisoma radians* (Cuv. & Val.) (*Scarus lacrimosus* Poey; ? *Scarus atomarius* Poey.)

One adult; two young. Caudal slightly rounded; canines 3-4 on each side, radiating; depth 3 in body.

Color dark brown, vaguely blotched with darker, the dark shades forming faint bars; a sharply defined blue streak from eye downward and forward, especially distinct in the young; chin with a faint white cross-band; axil dark; fins dark and almost plain; only the anal mottled.

This species, which has not yet been taken on the coast of the United States, seems to be the original *Scarus radians*. The species has been more or less confused with the next.

92. *Sparisoma hoplomystax* (Cope) (*Sparisoma cyanolene* Jordan & Swain).

One specimen; the characteristic blue area about the pectorals very distinct. More mottled than *S. radians*, with vague longitudinal streaks along the side. Chin with two white cross-bands, the posterior imperfect. A row of white specks bounding the blue of the pectorals.

I see no reason to doubt that *S. hoplomystax* was founded on a faded example of the species called *S. cyanolene*.

93. *Cryptotomus roseus* Cope.

Three specimens. A very slender fish, with long and very flexible dorsal spines, scarcely different from the soft rays. Scales on breast very

large; three before ventrals; three scales on cheeks; five before dorsals. Depth, $4\frac{1}{2}$ in length; head very long, 3. Snout sharp, containing eye $1\frac{2}{3}$ times.

Color in spirits brown, with four faint dark cross shades; the back finely mottled, the belly plain. A distinct dark spot at base of pectoral. Caudal with dark cross-bars; dorsal mottled; other fins plain

94. *Scarus guacamaia* Cuvier.

One specimen; very dark in color.

CEPHALACANTHIDÆ.

95. *Cephalacanthus volitans* (Linnæus).

One example.

TRIGLIDÆ.

96. *Prionotus punctatus* (Bloch).

One specimen. This species is allied to *Prionotus rubio*, with which it has been confounded, but differs sharply in the short pectoral, long gill-rakers, and in having a spine at the base of the preopercular spine. Our specimen agrees with the description given by Jordan & Hughes, except that it should be transferred to *ff* as having a larger mouth than the allies of *P. carolinus*. Maxillary $2\frac{1}{2}$ to $2\frac{2}{5}$ in head and reaching nearly to eye. Spinous dorsal merely blotched and without black ocellæ; pectoral dark, with three or four black bars; body nearly plain, clouded with dark and with some round brown spots above; caudal dark barred; groove behind eye very faint; gill-rakers rather long and slender; a small spine on center of radiation of cheek and one before it.

SCORPÆNIDÆ.

97. *Scorpæna brasiliensis* (Cuv. & Val.).

Identical with Florida specimens described as *Scorpæna stearnsi*.

GOBIIDÆ.

98. *Gobuis soporator* Cuv. & Val.

Common.

BLENNIIDÆ.

99. *Blennius cristatus* L.

Many specimens from Abrolhos Islands.

Dorsal XII, 5. Nape with a fringed crest of ten to eighteen filaments. A small trifid tentacle above eye; posterior canines in lower jaw only, short and small; gill membranes broadly united, nearly free from the isthmus. Dorsal slightly notched; nasal tentacle present. Color excessively variable, mostly grayish, with five or six cross blotches on the back, extending to form quadrate blotches on the side. Body

mottled; fins also mottled; the anal dark, with a pale edge. Some specimens highly variegated, the caudal banded and with black and white spots; pale streaks from the eye across the cheek; dark bars on sides, extending on dorsal. Most specimens have the region above anal with numerous round whitish spots and some dark ones. These spots sometimes nearly obsolete, most evident on the paler specimens. The synonymy of this species is uncertain. It is evidently the *Blennius crinitus* of Gunther and the *Blennius asterias* of Bean, probably the *nuchifilis* of Cuv. and Val., and in all probability the *cristatus* of Linnæus also. These nominal species are from various localities in the Atlantic. If our specimens are all alike, all these forms most likely belong to one species.

100. *Salariichthys textilis* (Quoy & Gaimard).

One specimen from the Abrolhos Islands.

Dorsal, XII, 16; anal, 18. Olive with 13 silvery cross streaks, not half as wide as the dark interspaces; some of the cross streaks Y-shaped. Both dorsals with cross markings, the second with twelve to thirteen streaks of dark obliquely upward and backward, alternating with similar pale streaks. Cross bars on sides bent in middle, extending up and back and down and back from middle line parallel with muscular impressions. Sides with some obscure pale dots; caudal barred with 7 dark bars; anal darkest mesially; lower side of head with dark streaks radiating from the isthmus; bars at chin Y-shaped, upper part of head with darker markings; pectoral nearly plain; a dusky area at base below which a dusky spot; marblings at base of dorsal; a few bluntish teeth on vomer; tentacles very small, fringed over nostril and eye, simple on neck; canines quite short; depth $4\frac{3}{5}$, head $4\frac{3}{5}$; pectoral short, little longer than head; gill membrane broadly united, free from isthmus; dorsal notched almost to base, free from caudal; orbital filament $\frac{1}{4}$ eye.

This specimen agrees fairly with the account given by Jenyns, but Jenyns describes five bars on the tail. It also agrees fairly with the account of the Bermuda specimens given by Goode. It is evidently the *Salarias vomerinus* of Cuv. & Val., and probably their *textilis* also; but their description of the latter does not apply very well to the coloration of our specimen.

BATRACHIDÆ.

101. *Marcgravia cryptocentra* (Cuv. & Val.).

Color, brown, clouded with black, the markings irregular and in coarse pattern; fins similar; ventral with a broad whitish edge; head more finely mottled; below reticulated with white; a black spot at center of base of pectoral; large fringed cirri above eye; skin rather thin and smooth; cirri about lower jaw, and some small ones on top of head. No pore in axil of pectoral, but some papillæ there. Dorsal spines wholly enveloped in skin, the soft rays nearly so, not easily

counted, their number about twenty-six. Three lateral lines, the pores sparse and with slight fringes; the middle row obscure with the pores wide apart. Teeth very blunt. General aspect of *Batrachus*.

PLEURONECTIDÆ.

102. *Syacium micrurum* (Ranzani).

Five specimens, similar to Cuban specimens, called *Hemirhombus ocellatus* by Poey.

103. *Paralichthys isosceles* (sp. nov.).

Three adult and one young specimen. Allied to *Paralichthys patagonicus* Jordan.

Head $3\frac{3}{5}$ in length, depth $2\frac{1}{20}$; scales 88 to 90; dorsal 84; anal 66. Length of types 5 to 11 inches (U. S. Nat. Mus.)

Body ovate, moderately compressed; eyes large, 5 in head, separated by a narrow, nearly or quite naked ridge, not one-fifth diameter of eye; teeth slender and sharp, the anterior enlarged but much less so than usual in *Paralichthys*; mouth rather large; maxillary scaly, $2\frac{1}{8}$ in head; caudal double truncate, the middle rays $1\frac{1}{5}$ in head; pectorals $1\frac{4}{5}$ in head; ventrals $3\frac{1}{5}$; scales finely ciliated; gill rakers 1+8 or 1+9, short and thick; longest gill raker less than one-third of eye. Curve of lateral line three and one half times in straight part, the arch much longer than high.

Color grayish brown, more or less mottled with darker; snout and lower jaw with dark spots. A vague darker spot just above bend in lateral line; another behind pectoral. Three large black ocelli in the form of an isosceles triangle, the hindmost on lateral line just before end of dorsal; the others one above the other below the lateral line, and near the outline of the body. Fins all more or less speckled or mottled with dark; the ventral blackish with two or three small inky spots; eyes not speckled.

104. *VERECUNDUM RASILE*, gen. & sp. nov. (allied to *Hippoglossina*).

One specimen.

Head $4\frac{2}{5}$ in length, depth $2\frac{1}{4}$; dorsal 87; anal 69; scales 90. Length of type (U. S. Nat. Mus.) 10 inches. Eyes and color on the left side; body oblong, elliptical, its outlines regular, its substance rather firm; caudal peduncle distinct, about as long as deep; head very small, little longer than deep; mouth much smaller than in related species, the maxillary reaching to below middle of eye, $2\frac{1}{2}$ in head, and about half longer than eye; teeth all small, bluntish, larger on the blind side of upper jaw where they are irregularly biserial; teeth of lower jaw and eyed side of upper, slender and short, subequal, nearly uniserial; gape oblique, nearly straight, the chin scarcely projecting; eyes large, $3\frac{3}{4}$ in head, separated by a narrow naked ridge; cheeks and opercles with small scales; jaws and snout naked; gill rakers short and slender, 5+10, the largest about as long as pupil; dorsal low in front, becoming

higher behind, its first ray over front of pupil; anal similar, but higher than dorsal; no anal spine; pectoral long and slender, $1\frac{1}{2}$ in head; ventrals very short, subequal, $2\frac{2}{3}$; caudal double truncate, the middle rays $1\frac{1}{2}$ in head; scales moderate, smaller on breast and head, all cycloid; lateral line very nearly straight, a short and shallow curve in front, the depth of which is about one-third its length, and scarcely equal to vertical diameter of eye.

Color brown, obscurely mottled with darker, the darker spots most distinct on the fins. A round diffuse black blotch as large as eye at beginning of straight part of lateral line, and another at end of its second third; a much smaller spot above lateral line before the posterior spot, and another below it, these three forming an equilateral triangle with the apex backward; another small black spot above curve of lateral line.

The single typical system in good condition is 10 inches long, and purports to have been taken at Bahia. It has, however, not the aspect of a tropical species, and possibly it may have come from the coast of Patagonia.

The genus *Verecundum* (Latin, *verecundus*, modest) is near to *Lyopsetta* and *Hippoglossoides*, from both of which it differs in its smooth scales. The head is smaller than in related genera. *Verecundum* also shows affinities with *Lioglossina*, *Xystreureys*, and other genera having a strong arch to the lateral line. *Verecundum*, *Hippoglossina*, *Lioglossina*, and *Xystreureys* mark the transition from the type of *Hippoglossoides* to that of *Paralichthys*.

105. *Citharichthys spilopterus* (Günther).

NOTE ON THE PLEURONECTIDÆ.

Since the publication of the "Review of the Flounders and Soles (*Pleuronectidæ*) of America and Europe" by Jordan and Goss, a number of important additions have been made to our knowledge of the group. I therefore give here a revised list of the species known from American waters. The sequence and classification follows that of the paper above cited, a few changes suggested by Dr. Gill in an excellent review of the same paper being accepted.

HIPPOGLOSSINÆ.

<i>Atheresthes stomias</i> (Jordan & Gilbert).	<i>Hippoglossina macrops</i> Steindachner.
<i>Platysomatichthys hippoglossoides</i> (Walbaum).	<i>Hippoglossina stomata</i> Eigenmann & Eigenmann.
<i>Hippoglossus hippoglossus</i> (L.).	<i>Hippoglossina bollmani</i> Gilbert.
<i>Lyopsetta exilis</i> (Jordan & Gilbert).	<i>Hippoglossina macrops</i> Günther.
<i>Eopsetta jordani</i> (Lockington).	<i>Lioglossina tetrophthalmus</i> Gilbert.
<i>Hippoglossoides platessoides</i> (Fabricius).	<i>Xystreureys liolepis</i> Jordan & Gilbert.
<i>Hippoglossoides elassodon</i> (Jordan & Gilbert).	<i>Paralichthys californicus</i> (Ayres).
<i>Psettichthys melanostictus</i> Girard.	<i>Paralichthys brasiliensis</i> (Ranzani).
<i>Verecundum rasile</i> Jordan.	<i>Paralichthys adspersus</i> (Steindachner).
	<i>Paralichthys dentatus</i> (L.).

Paralichthys lethostigma Jordan & Gilbert.	Paralichthys patagonicus Jordan.
Paralichthys squamilentus Jordan & Gilbert.	Paralichthys isosceles Jordan.
Paralichthys albigutta Jordan and Gilbert.	Paralichthys oblongus (Mitchill).
	Ancylosetta quadrocellata Gill.
	Ancylosetta dilecta (Goode & Bean).
	Ancylosetta dendritica Gilbert.

PSETTINÆ.

Bothus maculatus (Mitchill).	Platophrys lunatus (Linnaeus).
Trichopsetta ventralis (Goode & Bean).	Platophrys leopardinus* (Günther).
Platophrys tæniopterus Gilbert (genus nova?).	Engyophrys† sancti laurentii Jordan & Bollman.
Platophrys spinosus Poey.	Syacium cornutum (Günther).
Platophrys constellatus* Jordan.	Syacium papillosum (L.).
Platophrys ocellatus (Agassiz).	Syacium micrurum Ranzani.
Platophrys maculifer* (Poey).	Syacium ovale‡ (Günther).
Platophrys ellipticus* (Poey).	

* All these species are of doubtful. Perhaps *ocellatus* and *constellatus* are simply the young of *P. lunatus*.

† In this species the scales are ctenoid, not cycloid, as stated (by a slip of the pen) in the original description.

‡ *S. latifrons* Jordan & Gilbert, seems to be the male of this species.

Azevia panamensis Steindachner.	Citharichthys gilberti* Jenkins & Evermann.
Azevia querna Jordan & Bollman.	Citharichthys fragilis Gilbert.
Citharichthys sordidus (Girard).	Citharichthys microstomus Gill.
Citharichthys stigmeus Jordan & Gilbert.	Etropus ectenes Jordan.
Citharichthys xanthostigma Gilbert.	Etropus rimosus Goode & Bean.
Citharichthys dinoceros Goode & Bean.	Etropus crossotus Jordan & Gilbert.
Citharichthys arcifrons Goode.	Cyclosetta fimbriata (Goode & Bean).
Citharichthys unicornis Goode.	Thysanopsetta naresi Günther.
Citharichthys macrops Dresel.	Monolene sessilicanda Goode.
Citharichthys uhleri Jordan.	Monolene atrimana Goode & Bean.
Citharichthys spilopterus (Günther).	

* *Citharichthys sumichrasti* Jordan. The latter name was first printed, but the name *C. gilberti* has a slight priority in publication.

ONCOPTERINÆ.

Oncopterus darwini Steindachner.

PLEURONECTINÆ.

Pleuronichthys decurrens Jordan & Gilbert.	Limanda beani Goode.
Pleuronichthys verticalis Jordan & Gilbert.	Pseudopleuronectes americanus (Walbaum).
Pleuronichthys cænosus Girard.	Pseudopleuronectes pinnifasciatus (Kner).
Hypopsetta guttulata (Girard).	Liopsetta putnami (Gill).
Parophrys vetulus (Girard).	Liopsetta glacialis (Pallas).
Isopsetta ischyra (Jordan & Gilbert).	Platichthys stellatus (Pallas).
Isopsetta isolepis (Lockington).	Microstomus pacificus (Lockington).
Lepidopsetta bilineata (Ayres).	Microstomus bathybius (Gilbert).
Limanda ferruginea (Storer).	Glyptocephalus cynoglossus L.
Limanda limanda (L.).	Glyptocephalus zachirus Lockington.
Limanda aspera Pallas.	

SOLEINÆ.

<i>Solea brasiliensis</i> Cuvier.	<i>Achirus scutum</i> (Günther).
<i>Solea variolosa</i> Kner.	<i>Achirus garmani</i> Jordan.
<i>Achirus achirus</i> (L.).	<i>Achirus fimbriatus</i> (Günther).
<i>Achirus inscriptus</i> (Gosse).	<i>Achirus fasciatus</i> Lacépède.
<i>Achirus klunzingeri</i> (Steindachner).	<i>Achirus panamensis</i> (Steindachner).
<i>Achirus fischeri</i> (Steindachner).	<i>Achirus jenynsi</i> (Günther).
<i>Achirus mentalis</i> (Günther).	<i>Gymnachirus fasciatus</i> (Günther).
<i>Achirus lineatus</i> (L.).	<i>Gymnachirus nudus</i> (Kaup).
<i>Achirus lorentzi</i> (Weyenbergh).	<i>Achiropsis nattereri</i> (Steindachner).
<i>Achirus mazatlanus</i> (Steindachner).	<i>Achiropsis asphyxiatus</i> (Jordan).
<i>Achirus fonsecensis</i> (Günther).	<i>Apionichthys unicolor</i> (Günther).
<i>Achirus punctifer</i> (Castelnau).	

CYNOGLOSSINÆ.

<i>Symphurus marginatus</i> (Goode & Bean).	<i>Symphurus plagusia</i> (Bloch & Schneid.).
<i>Symphurus atramentatus</i> Jordan & Bollman.	<i>Symphurus plagiusa</i> (L.).
<i>Symphurus elongatus</i> (Günther).	<i>Symphurus pusillus</i> (Goode & Bean).
<i>Symphurus leei</i> Jordan & Bollman.	<i>Symphurus diomedeanus</i> (Goode & Bean).
<i>Symphurus atricauda</i> (Jordan & Gilbert).	<i>Symphurus piger</i> (Goode & Bean).
	<i>Symphurus nebulosus</i> * (Goode & Bean).

* A typical *Symphurus*; scales not keeled, but each has a medium dark streak, which gives an appearance of carination.

BALISTIDÆ.

106. *Monacanthus hispidus* (L.).

One large specimen not differing at all from specimens taken at Wood's Holl, Massachusetts.

107. *Monacanthus pullus* (Ranzani).

Brown; fins pale; no evident markings. Dorsal spine serrulate in front. This is evidently *Monacanthus ruppelli* of Castelnau.

108. *Alutera schöpfi* (Walbaum).

Dorsal, 37; anal, 40. Evidently *Alutera punctata* of Agassiz, but I can not distinguish it from specimens obtained at Martha's Vineyard.

109. *Balistes vetula* (L.).

Several specimens.

OSTRACIIDÆ.

110. *Ostracion tricornis* (L.). 111. *Ostracion trigonum* (L.).

TETRAODONTIDÆ.

112. *Spheroides testudineus* (Bloch).

This is *Tetraodon bajacu* of Castelnau.

FISHES FROM PATAGONIA.

Besides these species from Bahia and vicinity, a collection containing four species from Patagonia was sent with them for identification.

These species are the following:

1. *Psammobatis rutrum*, sp. nov.

Taken near Cape San Matios, $42^{\circ} 24''$ S. lat., $61^{\circ} 38' 30''$ W. long. at a depth of 43 fathoms. Station 2678. Dredged on January 14, 1888.

Allied to *Psammobatis rudis* Günther. Snout short, very bluntly rounded, its tip ending in a short, sharp, abruptly mucronate, fleshy tip, this exerted tip not quite half length of eye. This tip is the exerted snout which separates from each other the tips of the pectorals. Length of snout from mouth to the base of tip of snout not quite twice width of cleft of mouth. Length of snout from eye is $3\frac{1}{2}$ times interorbital space. Snout soft in substance, the rostral cartilages inconspicuous, the area between the pectorals translucent, broadly triangular. Disk just as broad as long and about one-fifth longer than tail, its outlines all rounded. Piracle considerably shorter than eye. Eye rather large, its length greater than interorbital width. Nostrils each with a conspicuous infolded tube-like flap; ventrals deeply notched on the side; the first rays thickened and produced. Tail with a distinct lateral fold. Dorsals moderate, close to the end of the tail, which has a well developed caudal, separate from the dorsal. Back and tail with a median series of strong spines, the strongest being at the shoulder; two irregular series on each side of this, the spines smaller than those of the median row; some additional spines on shoulder; series of stout spines above each eye; snout and anterior part of pectorals with small spines in numerous series; a patch of small spines on posterior part of pectoral; a large patch of spines still smaller and more closely set on ventral. Snout smooth below.

Color light brown, everywhere thickly speckled and freckled with blackish in fine pattern; each pectoral with about a dozen small round spots of the ground color, smaller than the eye, and each surrounded by a dark ring. Some of these spots are obscure and fade into the general coloration of the body. Upper part of eye spotted; middle part of snout with a large, triangular, translucent area. Some faint dusky spots on lower side of the outer margin of pectoral. This species is known from a single female specimen, $11\frac{1}{4}$ inches long, the tail $5\frac{1}{2}$, dredged by the *Albatross* off Cape San Matios, on the east coast of Patagonia. This species differs from *Psammobatis rudis* in having median row of spines instead of a median groove, in the different coloration, and the generally rougher disk.

2. *Acanthistius patachonicus* (Jenyns).

Eight large specimens.

Head $2\frac{1}{2}$ in length ($3\frac{1}{8}$ with caudal); depth, $2\frac{2}{10}$ ($3\frac{1}{2}$) D. XIII, 15, A. III, 8.

Scales 23-80-42. Length of largest about 10 inches.

General form that of a robust *Epinephelus*. Head closely scaled, the scales small except on the opercles; jaws naked; nostrils very small, subequal, oval; eye large, as long as snout, $4\frac{1}{2}$ in head; mouth large, the jaws subequal, the broad maxillary $2\frac{1}{3}$ in head, reaching to below middle of eye. Interorbital width $1\frac{1}{4}$ in eye, the surface rounded, with a median ridge. Teeth in bands, preceded by a row of short, stoutish canines, about three of those on side of lower jaw as large as those in front. Preopercle with its ascending limb sharply serrate, the lower teeth larger, its angle with a large tooth directed downward and backward, its lower limb with two very strong teeth directed forward and downward. Opercular spines strong, the middle one largest; two to six spinules on its lower angle at its junction with subopercle. Gill rakers moderate, $x + 14$.

Dorsal spines strong and rather low, the third and fourth longest, the spinous dorsal depressed behind; longest spine $2\frac{1}{3}$ in head. Caudal rounded, soft dorsal and anal rather high and rounded behind, second anal spine longest and strongest, 3 in head. Pectoral $1\frac{1}{2}$ in head, ventral 2.

Color rather light gray, the body covered rather sparsely with small dark-brown or black spots, these more or less confluent and forming more or less evident reticulations; these markings most distinct on the posterior and lower part of the body. Four distinct, narrow, black cross bars formed of these markings, on side of body extending from dorsal fin to level of pectoral. These bars similar and equidistant, about as broad as the pupil, and narrower than the interspaces; foremost bar under fourth dorsal spine; hindmost under front of soft dorsal. Vertical fins dark olive, both dorsals and anal spotted or reticulated with blackish. All markings are most distinct on the smaller specimens.

Head gray, nearly plain, a faint dark band from eye downward and backward. No black spots on head; pectorals olive; ventrals blackish; vertical fins without dark margins.

These specimens were obtained with the preceding off Cape San Matios.

3. *Notothenia longipes* Steindachner.

Dorsal V, 34; anal, 32; scales, 66; the pores, 53-2. The principal branch of the lateral line stops at a point three scales short of base of caudal. Many specimens.

Locality not given, but probably from Southern Patagonia.

These specimens agree well with Steindachner's description.

4. *Merluccius gayi* Cuv. & Val.

Many specimens. Locality not given; probably from the west coast of Patagonia. Dorsal, 10, 20, 17. Scales, 103. Longest ray of third dorsal $1\frac{1}{3}$ in longest of first dorsal and $2\frac{2}{3}$ in head. In *M. bilinearis*

these rays are equal and $2\frac{1}{2}$ in head. Canines smaller and fewer than in *bilinearis*. Ventrals $1\frac{9}{10}$ in head, reaching vent. Pectorals still further. Maxillary reaching posterior edge of pupil. Peritoneum, dusky silvery; front of mouth and inside of opercle not black; inside of mouth black behind.

CASTELNAU'S PLATES OF FISHES FROM BAHIA.

In the year 1855, Francis de Castelnau published an account of the fishes of Bahia and the neighboring ports under the title of "Animaux nouveaux ou rares recueillis pendant l'expédition dans les parties centrales de l'Amerique du Sud, de Rio de Janeiro à Lima, et de Lima au Para."

This work is illustrated by excellent colored plates, but the text is very poor. I give here an identification of the species represented in the plates by Castelnau omitting the *Siluridae*, *Cichlidae*, *Characinidae*, and other fresh-water forms.

Serranus caraua = Bodianus fulvus ruber.	Clinus fasciatus = Labrosomus fasciatus.
Serranus niveatus = Epinephelus niveatus.	Malthea notata = Malthe vespertilio.
Serranus onatalibi = Bodianus fulvus punctatus.	Acanthurus cœruleus = Acanthurus cœruleus.
Centropristis nebulosus = Serranus castelnau, nom. sp. nov., the name Serranus nebulosus being preoccupied.	Pristigaster phæthon = Pristigaster phæthon.
Pomacentrus pictus = Pomacentrus (fuscus var?) pictus.	Rhombus aramaca = Syacium micurum.
Pristipoma bicolor = Anisotremus bicolor.	Rhombus bahianus = Platophrys ocellatus.
Heliopsis marginatus = Chromis marginatus.	Plagusia brasiliensis = Symphurus plagusia.
Apogon americanus = Apogon americanus.	Monochir punctifer = Achiris punctifer.
Pomacentrus variabilis = Pomacentrus fuscus.	Muraenophis rostrata = Gymnothorax moringa.
Johnius amazonicus = Plagioscion squamosissimus.	Muraenophis curvilineata = Gymnothorax moringa?
Johnius auratus = Plagioscion auratus.	Muraenophis punctata = Muraena sp.
Johnius crouvina = Plagioscion auratus.	Muraenophis vicina = Gymnothorax vicinus.
Xyrichthyssplendens = Xyrichthyssplendens.	Muraenophis caramuru = Gymnothorax sp.?
Anastoma maregravii = Fistularia tabaccaria.	Muraenophis variegata = Gymnothorax ocellatus?
Acanthurus bahianus = Acanthurus bahianus.	Conger limbatus = Murænesox savanna.
Holacanthus formosus = Holacanthus formosus.	Conger microstoma = Ophisomus ophiophthalmus.
Plataxoides dumerili = Plataxoides dumerili (?)	Conger multidens = Conger multidens.
	Ophisurus gomesi = Ophichthus gomesi.
	Monacanthus ruppelli = Monacanthus pullus.
	Tetraodon bajacu = Spheroides testudineus.
	Uraptera agassizii = Raja agassizii.

NOTES ON THE OSTEOLOGY OF THE PARIDÆ, SITTA, AND CHAMÆA.

BY

FREDERIC A. LUCAS,

Assistant Curator of the Department of Comparative Anatomy.

(With Plate XXVII).

In studying any group of oscinine birds it is impossible, or at the best extremely difficult, to tell where to stop, and the question is quite as often decided by the lack of material as by any other cause.

Thus the present paper is the outcome of a study of the *Mimina*, which naturally included the Wrens also, and from them led by way of *Chamæa* to the Titmice, and but for the cause above mentioned might be indefinitely extended.

Dealing chiefly with North American species these notes are naturally incomplete; but, as the accumulation, proper preparation, and study of osteological material are necessarily slow, they are put forth with an apology for not being more comparative in their nature.

I give below a list of the species examined and all references to the *Paridæ* mean the group as thus represented.

Parus major
ater
carolinensis
atricapillus
montanus
hudsonicus
cæruleus
bicolor

Parus inornatus
gambeli
Psaltiriparus plumbeus
minimus
Auriparus flaviceps
Ægithalus caudatus
Chamæa fasciata
Sitta canadensis.

The above are all represented in the collections of the U. S. Museum, but I am indebted to Dr. R. W. Shufeldt for the privilege of examining a large number of specimens in his collection.

In the genus *Parus*, as here represented, the brain case is large, the beak short, stout, and conical.

The interorbital septum is well ossified up to the point of exit of the olfactory nerves, although small perforations may be present in the septum, as in *Parus bicolor*, *hudsonicus*, *gambeli*, and *inornatus*.

The vacuity in the skull at the point of exit of the olfactory nerves is small; much larger in *P. hudsonicus* than in any other species examined.

The premaxillaries and nasals fuse early in life, and are cut squarely across at their posterior extremities, where they are movably articulated with the frontals, as in parrots, the maxillary being also movably articulated with the premaxillary.

The narial openings are small, a short ellipse in shape, with the external process of the nasal continued but a short distance along the premaxillary.

The transpalatines are subacuminate and, as well as the postpalatines, much produced downward and slightly backward.

The prepalatines are moderately stout and seem to increase in width with age.

The manner in which the palatines join the premaxillaries can be seen only in rather young birds, for, with age, ossification invades the membranous anterior portion of the palatal region, not only concealing the terminations of the palatines, but forming a line across them that so strikingly simulates a suture as to have deceived not only the writer, but so keen an observer as Dr. Parker, who has figured this groove as a suture.

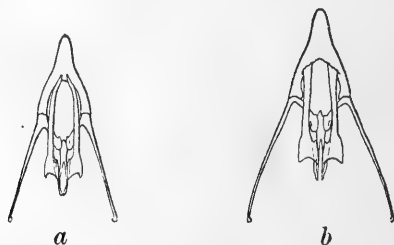


FIG. 1.—*a*, palatal region of a rather young specimen of *Parus hudsonicus*, showing the anterior ends of the palatines; *b*, palatal region of an old specimen of *Parus bicolor*, with the anterior ends of the palatines fused with the premaxillaries. Both figures enlarged.

The mandible has a large elliptical perforation, and there are two mandibular sesamoids, one behind and one at the outer side of the articulation.

In *Parus bicolor* the vertebral arteries enter the cranium a little above the foramen magnum, while in the other members of the genus *Parus* these arteries pierce the skull right on the edge of the foramen.

Except in this slight particular, I find no difference between *P. bicolor* and its near relatives.

In the skull of *Auriparus* we meet with a departure from that of *Parus* in the open orbital septum, this consisting of a very slender bar of bone; otherwise the skulls of the two genera are very similar in structure.

The mandibular perforation of *Auriparus* is very small.

In *Ægithalus* the interorbital septum is a slender bar, there is no cranio facial hinge, the maxillary and premaxillary are fused, and the vacuity at the exit of the olfactory nerves is large.

The general aspect of the cranium, however, is Parine in spite of the peculiar curve of the beak; the narial opening are small ellipses; the external process of the nasal is continued but a short distance along the premaxillary, and the prepalatine bars are broad, although they join the premaxillaries in a slightly different manner than in *Parus*.

Psaltriparus has scarcely a cranial character in common with other *Paridæ*, the interorbital septum being open and the vacuity at the exit of the olfactory nerves large, while there is no maxillo-premaxillary nor cranio-facial hinge, the nasals overlapping the frontals for a considerable portion of their extent.

The narial openings are large, elongate ellipses, although the external process of the nasal is continued but a moderate distance along the premaxillary; the prepalatines, which are narrow rods, are for some distance in contact with the premaxillaries and the trans and postpalatine processes are slightly different in shape and arrangement from what is found in other *Paridæ*.

In short, judging from the cranium alone, *Psaltriparus* would scarcely be considered a Tit at all.

The maxillo-palatines are more slender and less pneumatic in *Psaltriparus* than in other members of the group, but with that exception these little processes seem to be uniform in pattern throughout the various species, although I am unable to speak as positively on this point as I would like.

In a previous paper it was noted that the anterior termination of the vomer was subject to great specific variation, and in this respect the *Paridæ* are truly remarkable, the vomer varying from sharply spear-shaped in *Parus inornatus griseus* to abruptly truncate in *Parus carolinensis*.

Anterior end of vomer of—

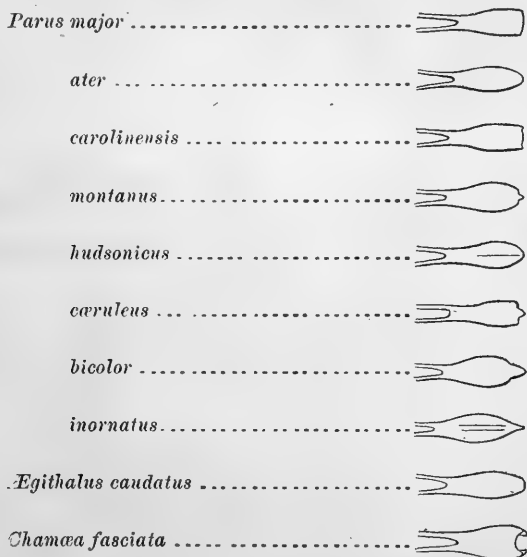


FIG. 2.—All the above are enlarged and drawn to the same absolute scale.

The thoracic skeleton of the *Paridæ* bears the same stout, compact character that is seen in the external appearance of this group of birds, the chest cavity being deep, the sternum of good size and well keeled.

The sternum flares considerably posteriorly and the costal processes are high, acuminate, and directed well forward, their shape being practically the same throughout the group.

The varying pneumaticity of the sternum will be treated of further on, but it may be noted that when this bone is pneumatic there is a single opening in the dorsal aspect of the sternum just above the anterior origin of the keel.

The coracoids possess a moderate flange, or ridge, running from the epicoracoid about half way up the shaft, but it is by no means so well developed as in the Thrushes, where this character appears to be carried to its extreme.

The hypocleidium is long, slender, and bent upward much as in the Wrens.

The scapula is stout and regularly curved downward for its distal half, the various species examined being unusually uniform in respect to the shape of this very variable bone.

The dorsal aspect of the pelvis, which is constant in shape throughout the group, so far as examined, can be better understood from the accompanying figure than from any detailed description.

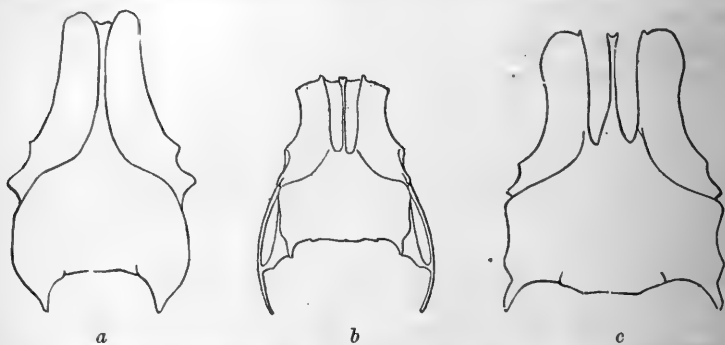


FIG. 3.—a, pelvis of *Campylorhynchus affinis*; b, pelvis of *Parus bicolor*; c, pelvis of *Merula migratoria*.

In general pattern it very closely resembles that of the Thrushes, the posterior portion in particular being characterized by the breadth and squareness so marked in that group of birds.

The ilio-neural grooves are open, and the obturator foramen is separated by a considerable bar of bone from the obturator space.

The "sacrum" is wide, more or less keeled and deeply pitted, the pits seemingly marking the intercentral spaces.

If I am correct in my count the following species have the "sacrum" composed of five presacrals, two sacrals, and five caudals: *Parus ater*, *P. carolinensis*, *P. montanus*, *P. hudsonicus*, *P. cæruleus*, *P. bicolor*, *Auriparus flaviceps*, *Ægithalus caudatus*.

The only specimen of *Parus major* at hand appears to have but four presacrals, two sacrals, and four caudals, but there is an abnormal look about this sacrum, and there seems to be a little uncertainty (if the

term is allowable) in the development of the sacral parapophyses in the various species.



FIG. 4.—Composite sacrum of *Parus carolinensis*, the right and left halves being from two individuals. Enlarged. The difference between the last two presacrals of either side should be noted, as well as the fact that there is one more parapophysis on the left half of the figure than on the right.

The species in hand have each six free caudals and a pygostyle, with the exception of *Egithalus*, which has seven caudals and a pygostyle.

The fore and hind limbs are respectively made on the same plan throughout the group, and there is little to be said regarding them.

The following table shows the pneumatic or non-pneumatic condition of the sternum and humerus in the various species examined, the two species of *Polioptila* being introduced to show that variation in this respect may occur in closely related species.

The columns headed above and below denote that the pneumatic foramina are respectively above or below the septum dividing the pneumatic fossa, and in two cases it will be seen that foramina exist on both sides of the septum, the opening above being much the larger.

	Sternum.		Humerus.		Above.	Below.
	Pneumatic.	Non-pneumatic.	Pneumatic.	Non-pneumatic.		
<i>Parus major</i>	×		×		×	
<i>ater</i>						×
<i>carolinensis</i>						
<i>atricapillus</i>						×
<i>montanus</i>					×	
<i>hudsonicus</i>						
<i>cæruleus</i>						
<i>bicolor</i>	×		×			×
<i>inornatus</i>	×		×		×	×
<i>gambeli</i>						
<i>Psaltiriparus plumbeus</i>						
<i>minimus</i>						
<i>Auriparus flaviops</i>						
<i>Egithalus caudatus</i>						
<i>Chamaea fasciata</i>						
<i>Sitta canadensis</i>						
<i>Polioptila plumbea</i>						
<i>cærulea</i>		×	×			×

This table shows that the larger Titmice usually, although not always, have a pneumatic sternum and humerus, while in the smaller species these bones are non-pneumatic. It also shows that, while a pneumatic sternum is usually correlated with a pneumatic humerus and

a non-pneumatic sternum with a non-pneumatic humerus, exceptions to this are by no means rare, and that the character is of little taxonomic value.

To briefly sum up, the family *Paridæ* as it now stands comprises birds differing very decidedly in cranial character, and while the genera *Parus*, *Auriparus*, *Ægithalus*, and *Psaltriparus* may be craniologically diagnosed, I confess my inability to assign osteological characters to the group.

That the group is not a natural one I should hesitate to assert, but it is by no means so homogeneous as the Swallows, Wrens, or Thrushes, so far as I have studied them.

The genus *Sitta* is sometimes placed among the *Paridæ*, but, taking *Sitta carolinensis* as a typical member of the genus, it differs from the Titmice and especially from *Parus* in many important particulars.

The skull of *Sitta* resembles that of *Parus* in having a nearly closed interorbital septum and broad prepalatines. On the other hand, the skull of *Sitta* is slightly depressed instead of elevated, there is no fronto-nasal nor maxillo-premaxillary hinge, the narial openings are elongate ellipses, the nasals are very peculiar in form, with the external process carried for a considerable distance along the premaxillary, and the transpalatines and postpalatines are but slightly bent downward.

The prepalatines of *Sitta* too overlies and fuse with the premaxillaries, while in the *Paridæ* the prepalatines run along the inner edge of the premaxillaries and the bones are soldered together by the deposition of osseous matter in the surrounding membrane.

Sitta also has what is unusual in the smaller Passeres, a large, free lachrymal, much as in the *Corvidæ*, and the quadrate is so compressed vertically that the pterygoid lies immediately under, and almost in contact with, the ascending process, as in the *Caprimulgidæ*.

The pelvis of *Sitta* is anteriorly much narrower than in any of the *Paridæ*, the ischium and pubis project farther downward and backward than in this group, and the obturator foramen is connected with the very large obturator space.

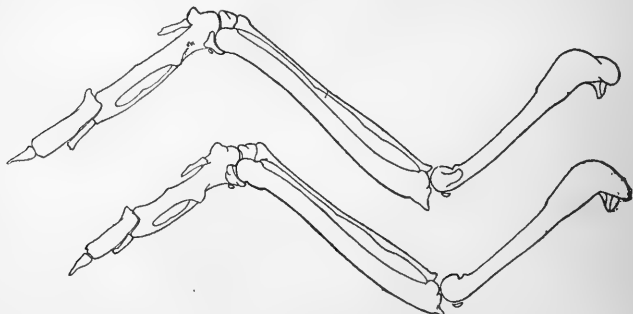


FIG. 5.—Dorsal aspect of left wings of *Sitta carolinensis* and *Parus bicolor*. Enlarged.

Sitta, moreover, is peculiar in having—compared with the humerus—a somewhat elongate fore arm and manus, differing in this respect from the Tits, and very much resembling the *Corvidæ*.

The tibia of *Sitta* is characterized by the curious shape of its proximal portion, where it is thin and bent inward; but as something very similar occurs in *Certhia* this would seem to be a teleological modification from climbing.

The tibia is also proportionately shorter in *Sitta* than in *Paridae*, while the first phalange of the first digit is remarkably long.

Taking all skeletal characters into consideration, the differences between *Sitta* and the *Paridae* are such as would seem to preclude their being grouped together, while the peculiarities in the wing of *Sitta*, slight as they may appear, when added to the other characters, seem sufficient to warrant the assignment of the genus to a separate family.

At the same time I wish to qualify this by saying that until more species of the genus and those genera apparently allied to it have been worked out the matter cannot be considered as settled.

The last form to be considered in this paper is *Chamaea*.

This genus was placed by Sundevall in his group *Toxostominae* next to *Galeoscoptes*, and in Gray's Hand List stands as a family between *Paridae* and *Mniotiltidae*.

Professor Baird in the Birds of North America makes *Chamaeinae* a subfamily of Wrens and in his Review of American Birds elevates it to family rank between *Paridae* and *Sylviolidae*, with the remark that "it may properly belong to some Old World group."

Dr. Cones, in the Key to North American Birds, puts the family *Chamaeidae* between *Syviidae* and *Paridae*, adding that it may be placed with the *Timeliidae* as justly as many other forms.

Mr. Sharpe, in the British Museum Catalogue of Birds, Vol. VII, creates the group *Chamaea* in the family *Timeliidae*, the Wrens also being relegated to this family. He says:

The curious little bird which forms the single representative of the present group possesses characters which seem to ally it to several other groups; and it is not surprising that it has been considered by Professor Baird to belong to a separate family, *Chamaeidae*. The wing is essentially Timeliine, being concave and rounded, with a large first primary; the legs, too, are strong; but in other respects the general aspect of the bird is Titlike, and Professor Baird places it in close proximity to the Tits in his "Review."

In the A. O. U. Check List *Chamaea* appears with other genera in a subfamily (*Chamaeinae*) of *Paridae*, and in Ridgway's Manual of North American Birds it also figures under *Paridae*, but with the following note:

I have been obliged to assign different limits to the subfamilies *Parinae* and *Chamaeinae* from those given in the A. O. U. Check List, on account of the impossibility of giving characters which would cover the extremely different genera there inadvertently placed under *Chamaeinae*. The latter properly includes only *Chamaea*; and it is extremely doubtful whether this genus has any real affinity with the *Paridae*, its relationship being probably much nearer to the *Troglodytidae*.

In the Standard Natural History, Mr. Stejneger is "most inclined to regard the *Chamaeinae* only as a subfamily of the Wrens," and my own

expressed opinion was that *Chamæa* appeared "most decidedly to belong with the Wrens, and not with the Titmice."

Finally, Dr. Shufeldt, in a paper in the Journal of Morphology, says that, "so far as its topographical anatomy and characters are concerned, *Chamæa* shows a far closer kinship with *Psaltriparus* than it does with any of our typical North American Wrens."

Craniologically *Chamæa* is much like *Psaltriparus*, and in those points in which *Psaltriparus* differs from *Parus*, by just so much does it approach *Chamæa*.

This bird has an open interorbital septum, a large cardiform vacuity at the exit of the olfactory nerves, no maxillo-premaxillary nor cranio-facial hinge, elongate elliptical narial openings, and the external process of the nasal continued but a short distance along the premaxillary.

All these characters, save the last, are found in the Wrens as well as in *Psaltriparus*, and probably in numberless other Passeres and simply illustrate the great similarity of structure obtaining in the order.

In the Wrens, the external process of the nasal runs nearly the entire length of the narial opening, there is usually a small, laminar lachrymal present and the maxillo-palatines have a peculiar hamate form and are non-pneumatic.

In *Chamæa*, as in the *Paridæ*, the maxillo-palatines are pneumatic although the shape of these processes differs in the two groups.

The shoulder-girdle of *Chamæa* is extremely feeble, the keel of the sternum being lower than in *Psaltriparus minimus*, and the wing much shorter than in *Parus carolinensis*.

The distinctions between the shoulder-girdle of *Chamæa* and the Titmice are teleological rather than morphological, and this is equally true of the same parts in the Wrens and Titmice, the Wrens being narrow-chested weak-armed birds, while the Tits are sturdy, full chested, and strong-armed.

Like the Wrens *Chamæa* has the ridge running upward from the epicoracoid almost obsolete, and this is a point of some value, its presence or absence apparently having nothing to do with power of flight.

The coracoid of *Chamæa* seems unusually long, but the length is apparent, and not real, being due to the small size of the associated parts.

The sacrum of *Chamæa*, like that of the *Paridæ*, is broad and deeply pitted, but here similarity between the pelvic girdles of the two ceases.

Viewed from above, the pelvis of *Chamæa* is anteriorly narrow and posteriorly contracted, as in Wrens, possessing the characteristic angular aspect peculiar to the pelvis of that group.

Viewed laterally the dorsal outline of the pelvis is alike decurved in *Chamæa* and the Wrens, the dorsal outline of the pelvis in the *Paridæ*—as in the Thrushes—being much straighter.

The renal fossæ in *Chamæa* are shaped as in the Wrens, being more sharply triangular than in the *Paridæ*.

In proportionate length of hind limb *Chamæa* surpasses any of the Wrens and greatly exceeds any Titmouse.

The tibia and tarsus of *Chamæa* are as long as the corresponding bones in *Campylorhynchus*, and but for the shorter femur of *Chamæa* the hind limbs of the two birds would be of the same length, although *Campylorhynchus* is almost one-half the longer of the two, and certainly four times as heavy.

In the arrangement of the phalangeal articular facets *Chamæa* is wren-like, the second and fourth being in the same plane, while in the *Paridae* the second is above the fourth.

Chamæa is characterized by a considerable development of the procnemial ridge, this probably bearing some relation to its ground-haunting habits; still the amount of development of the pro and ectocnemial ridges is variable, both among the Wrens and Tits.

It appears, then, that in its cranial characters *Chamæa* is much like *Psaltriparus*, while the shoulder girdle is slightly and the pelvic girdle decidedly wrenlike.

Dr. Shufeldt's conclusion that *Chamæa* finds its nearest relative in *Psaltriparus* was therefore more correct than my own, that *Chamæa* belonged with the Wrens, and I can only say that at the time I ventured this opinion *Psaltriparus* was not available.

On the other hand, none of the characters shown in the skeleton of *Chamæa* seems sufficient to warrant placing the genus either with the Wrens or Tits, but rather bear out the intermediate position indicated in the name of Wren-Tit.

That *Chamæa* should show resemblances to or leanings toward more than one group of birds is not at all surprising, for, as Professor Newton most truly says:

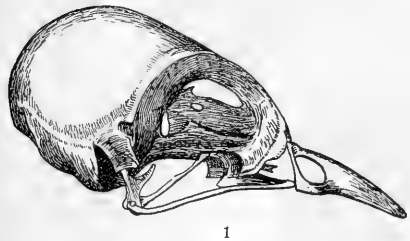
This last and highest group of birds (Oscines) is one which, as before hinted, it is very hard to subdivide.

Some two or three natural, because well differentiated, families are to be found in it. * * *

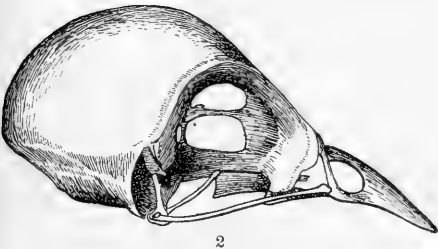
But the great mass, comprehending incomparably the greatest number of genera and species of birds, defies any sure means of separation. Here and there, of course, a good many individual genera may be picked out capable of the most accurate definition, but genera like these are in the minority and most of the remainder present several apparent alliances from which we are at a loss to choose that which is nearest. * * * We may take examples in which what we may call the Thrush form, the Tree creeper form, the Finch form, or the Crow form is pushed to the most extreme point of differentiation, but we shall find that between the outposts thus established there exists a regular chain of intermediate stations so intimately connected that no precise lines of demarkation can be drawn cutting off one from the other."

Limited as my studies of the skeletal characters of the Oscines have been they are sufficient to emphasize the above remarks, and it is probably not assuming too much to say that with a sufficiently large series of specimens any two oscinine birds may be osteologically linked together.

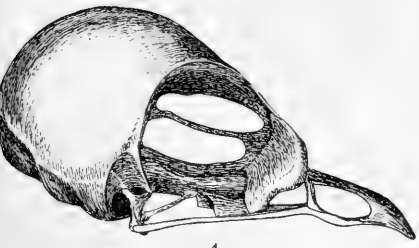




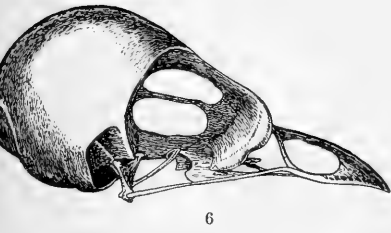
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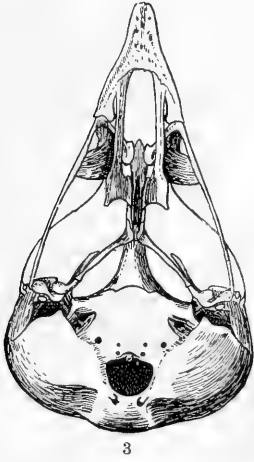
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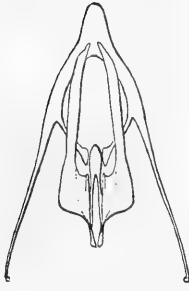
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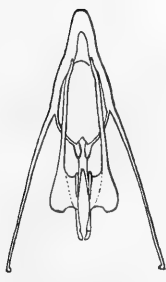
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5



7

OSTEOLOGY OF PARIDÆ, SITTA, AND CHAMÆA.

- | | | |
|---------------------------------|------------------------------------|--------------------------------------|
| 1. <i>Parus major</i> . | 3. <i>Parus bicolor</i> . | 6, 7. <i>Psaltriparus plumbeus</i> . |
| 2. <i>Auriparus flaviceps</i> . | 4, 5. <i>Aegithalus caudatus</i> . | |



NOTE ON THE ASPREDINIDÆ.

BY

THEODORE GILL, M.D., PH.D.

Dr. and Mrs. Eigenmann, in their very important and well considered contributions to the systematic history of the Nematognaths of South America, have substituted for the *Aspredinidæ* the name *Platy-stacidæ*. This was evidently done on the ground that the name *Aspredo*, although early used by Linnæus and Gronovius, was abandoned by Linnæus in the later editions of the "Systema Naturæ" and was not used by a binomial writer till after Bloch had given to the corresponding group the generic name *Platystacus*.

The logic in this case was good but there are other elements to be considered and a more complete survey of the literature will reveal that *Aspredo* can still be retained as a generic name and consequently *Aspredinidæ* as a family name.

I.

Aspredo was framed by Linnæus as a name for the species generally known later as *Aspredo lavis* or *batrachus*. It was given as a unino-mial name and apparently because the author had not satisfied himself as to the proper generic relations of the species; it was not given as a true generic designation.*

II.

Aspredo was first taken up as a generic name by Gronow (Gronovius) who, in the first volume of his *Museum Ichthyologicum* (p. 8, 1754), made known a species now generally called *Aspredo cotylephorus*, but supposed by him to be the Linnæan species.

III.

Aspredo was adopted as a genus by Linnæus in the ninth edition of his "Systema Naturæ," which was edited by Gronovius, and in which the system and genera of Gronovius were adopted for the class of fishes

*The description and figure in the *Amœnitates academicae* (v. I, p. 593, pl. 2, f. 5) are in the dissertation entitled "Laurentii Balk, Gerali-Gestric, Museum-Adolpho-Fredericianum," Balk being a student who defended the thesis (May 31, 1746) and not the real author.

(1756, 6).^{*} The only reference under the genus was to Gronovius, viz: "*Aspredo*. Gr. M. Ichth. n. 26. 5. 8. 6. 55. 9.†

IV.

Aspredo was abandoned as a generic term by Linnæus in the latter editions of his *Systema Naturæ*, wherein the well-known arrangement of his own invention was applied and the species referred to the genus *Silurus*, the fish originally figured in the "*Amœnitates Academicæ*" and the Gronovian species being both referred to the "*Silurus aspredo*."

V.

Aspredo having been previously only published in non-binomial works, and having been repudiated as a generic name by Linnæus, was thus left in abeyance, and in accordance with the rules of nomenclature adopted, if not previously reënforced, would be superseded by any other name later given. Bloch long afterward gave the name *Platystacus* to a compound of *Aspredinidæ* and *Plotosidæ*, and that name has been logically adopted for the chief *Aspredinoid* genus by Dr. and Mrs. Eigenmann, who were unacquainted with any use of the name *Aspredo* between the tenth edition of Linnæus and the work of Bloch. But the generic name *Aspredo* was actually reënforced.

VI.

In 1777, J. A. Scopoli published an "*Introductio ad Historiam Naturalem*," in which he adopted most of the Gronovian as well as Linnæan genera, and among them was *Aspredo*. The genus was defined in the following terms:

271. *Aspredo*, Gronov. Membrana branch. oss. 4. Radius pinnæ pectoralis anterior validissimus, dentato-serratus.

The name is thus validated as a binomial generic term, whatever may be considered to be the typical species. But some difference of opinion is possible on account of certain complications resulting from the publication of Swainson's unscientific work.

VII.

Platystacus was a name introduced by Bloch in 1794 for the species of *Aspredo* of Gronovius and consequently Scopoli, but he also confounded, under the same name, species of the genus later called *Plotosus*.

Practically, however, *Platystacus* Bloch is a synonym of *Aspredo* (Gron.) Scopoli.

^{*}Characteres in singulis partibus eisdem agnovi, quos in priori editione recitavi; scilicet; *Ichthyologiam* vero secundum Membranas Branchiostegas et pinnarum radios compendiose tali ordine proposui, quali exstat in Gronovii Museo Ichthyologico, cujus nova detecta Genera huc introduxi. Linnæus, o. c., Lectori, 3d leaf.

†The numbers indicate the radial formula, viz: D. 5, P. 8, V. 6, A. 55, C. 9.—A diagnosis of the genus was given.

VIII.

The genera *Aspredo* and *Platystacus* contained, besides the first species made known (characterized by a long tail and anal fin), one species with a short tail and analis. To the latter type *Aspredo* was restricted by Swainson, and to the former a new name (*Cotylephorus*) was given. The name *Platystacus* was transferred to the genus later called *Chaca*, but of which no species was known to Bloch.

CONCLUSIONS.

Various views may be taken of the questions thus indicated. Some might contend that the typical species of *Aspredo* was that first made known under that name. Others might claim that inasmuch as Gronovius was not a binomial author, all the species were on the same level and that consequently *Aspredo*, adopted from Scopoli, might be restricted to any genus represented by species comprised (by implication) in his genus. Still others might urge that the species figured by Gronovius and not the Linnæan fish should be the type. I do not propose to waste time by supposing and meeting the arguments that might be urged. The most expedient course, it seems to me, will be to accept the genus as from Scopoli, but, inasmuch as he adopted it from Gronovius, to take as the type a species first known to him. Gronovius, in his turn, adopted the name from Linnæus, and accordingly the Linnæan species may be considered as the type. We are thus led to the nomenclature of Bleeker and most modern authors. Bleeker has chosen to retain the name *Platystacus* for a genus (probably rather a subgenus) of the family, and inasmuch as he has limited the name to one of the species known to Bloch, he appears to have been justified in doing so. The fact that a *Plotosus* was figured in the "Systema Ichthyologiae" as illustrative of *Platystacus* is not, I think, sufficient to attach the name to the genus *Plotosus*.

The synonymy of the family and included groups may be useful as a synoptical expression of the facts detailed.

ASPREDINIDÆ.

Synonyms as family names.

- < *Oplophores*, Duméril, Zool. Anal., p. 141, 1806.
- < *Siluridi*, Rafinesque, Indice d'Ittiolog. Siciliana, p. 35.
- < *Oplophoria*, Rafinesque, Analyse de la Nature, 17. fam., p. 89, 1815.
- < *Siluroides*, Cuvier, Règne Animal, [1. éd.,] t. 2, p. 199, 1817; 2. éd., t. 2, p. 289, 1829.
- < *Siluroidei*, Latreille, Fam. Nat. Règne Animal, p. 124, 1825.
- < *Siluridae*, Bonaparte, Giorn. Arcad. di Scienze, v. 52, (Saggio Distrib. Metod. Animal. Vertebr. a Sangue Freddo, p. 37,) 1832.
- < *Silurida*, Bonaparte, Nuovi Annali delle Sci. Nat., t. 2, p. 131, 1833; t. 4, p. 188, 1840.
- < *Silurida*, Swainson, Nat. Hist. and Class. Fishes, etc., v. 2, pp. 195, 333, 1839.
- < *Siluroidei*, Müller, Archiv f. Naturgesch., 9. Jg., B. 1, p. 317, 1843.
- < *Siluroidei*, Müller, Archiv f. Naturgesch., 11. Jg., B. 1, pp. 131, 136, 1845.
- < *Silurida*, Bonaparte, Cat. Metod. Pesci Europei, p. 37, 1846.
- < *Siluroidei*, Kner, Sitzungsber. k. Akad. Wissensch. (Wien), v. 42, p. 257, 1861.

- < *Siluridæ*, Richardson, Enc. Brit., 8th ed., v. 12, p. 261, 1856.
 < *Aspredinidæ*, Adams, Man. Nat. Hist., p. 107, 1854.
 = *Aspredinoidei*, Bleeker, Ich. Arch. Indici Prod., v. 1, pp. 36, 327, 1858.
 = *Aspredinoidei*, Bleeker, Enum. Sp. Piscium Archipel. Indico, p. xxviii, 1859.
 = *Aspredinoidei*, Bleeker, Nederl. Tijdschr. Dierk., v. 1, p. 117, 1863; Atlas Ich. Indes Néerland., v. 2, p. 18, 1862-3.
 < *Siluridæ*, Günther, Cat. Fishes Brit. Mus., v. 8, p. 19, 1870.
 = *Aspredinidæ*, Cope, Proc. Am. Assoc. Adv. Sci., v. 20, p. 331, 1872.
 = *Aspredinidæ*, Gill, Arrangement Fam. Fishes, p. 19, 1872.
 < *Siluri*, Fitzinger, Sitzungsber. k. Akad. Wissensch. (Wien), B. 67, 1. Abth. p. 44, 1873.
 = *Aspredinidæ*, Jordan, Standard Nat. Hist., v. 3, p. 112, 1885.*
 < *Bunocephalidæ*, C. and R. Eigenmann, Am. Nat. v. 22, p. 648, 1888; Rev. S. Am. Nematognathi, pp. 9, 12, 1890.

The absence of an operculum has been given by late authors as characteristic of this family. I am skeptical, however, whether the bone is really wanting, and indeed the attribute is in contradiction to the statement of Valenciennes, who has asserted that the bone, although vestigiary, is present but entirely soldered to the preoperculum.† Dr. Eigenmann, in a recent conversation with me, agreed that the bone might perhaps be found. The species of the family in the National Museum unfortunately are represented by unique specimens, and consequently can not be dissected. It is to be hoped that an investigation of the question may soon be made.

ASPREDININÆ.

Synonyms as subfamily names.

- < *Siluridia*, Rafinesque, Analyse de la Nature, p. 89, 1815.
 < *Anesipomes*, (tribu) Latreille Fam. Nat. Règne An., p. 125, 1825.
 < *Pimelodini*, Bonaparte, Nuovi Annali d. Sci. Nat., t. 2, p. 133, 1839; t. 4, p. 276, 1840.
 < *Aspredinæ*, Swainson, Nat. Hist. and Class. Fishes, etc., v. 1, p. 332, 1838; v. 2, pp. 189, 308, 1839.
 < *Pimelodini*, Bonaparte, Cat. Metod. Pesci Europei, p. 5, 1846.
 = *Aspredini*, (cohors) Bleeker, Ich. Arch. Indici Prodr., v. 1, p. 328, 1858; Enum. sp. Piscium Archipel. Indico, p. xxviii, 1859.
 = *Asprediniformes*, Bleeker, Nederl. Tijdschr. Dierk., v. 1, p. 117, 1863; Atlas Ich. Indes Néerland., v. 2, p. 18, 1862.
 < *Siluridæ Proteropodes* (group *Aspredinina*) Günther Cat. Fishes B. M., V. 5, pp. 11, 12, 266, 1864.
 = *Platystacina* C. and R. Eigenmann, Rev. S. Am. Nematognathi, pp. 9, 20, 1890.

Genera.

1. *Aspredo* (Gron.) Scopoli Int. ad Hist. Nat., p. 453, 1777 = *Platysyacus* Bloch Ausland. Fische, v. 8, p. 63, 1794 = *Platistus* Raf. An. Nat., p. 89, 1815 = *Cotylephorus* Swainson Nat. Hist. Fish., etc., v. 1, p. 332, 1838; v. 2, p. 308, 1839. Type *A. Batrachus* (Linn.)

* Dr. Jordan adopted the name *Platystacus* instead of *Aspredo*.

† Les trois pièces operculaires sont réduites à de simples vestiges et entièrement cédées au preopercule, en sorte que la dilatation et la contraction de leurs ossements ne dépendent que de l'arcade palato-ptérygoïdiennes. Cuv. et Val., xv, 429, 1840.

2. *Aspredinichthys* Bleeker Ich. Arch. Indici Prodr., v. 1, p. 323, 1858; Nederl. Tijdschr. Dierkunde, v. 1, p. 118, 1863.

Type *A. tibicen*—*Aspredo tibicen* Temminck.

BUNOCEPHALINÆ.

Synonyms as subfamily names.

- < *Siluridia*, Rafinesque, Analyse de la Nature, p. 89, 1815.
 < *Anesipomes* (*tribu*) Latreille Fam. Nat. Règne An., p. 125, 1825.
 < *Pimelodini*, Bonaparte, Nuovi Annali d. Sci. Nat., t. 2, p. 133, 1839; t. 4, p. 276, 1840.
 < *Aspredinæ*, Swainson. Nat. Hist. and Class. Fishes, etc., v. 1, p. 332, 1838, V. 2, pp. 189, 328, 1839.
 < *Pimelodini*, Bonaparte, Cat. Metod. Pesci Europei, p. 5, 1846.
 = *Bunocephalini* (*cohors*) Bleeker Ich. Arch. Indici Prodr., v. 1, p. 328, 1858; Enum. sp. Piscium Archipel. Indico, p. XXVIII, 1859.
 = *Bunocephaliformes*, Bleeker, Nederl. Tijdschr. Dierk., v. 1, p. 117, 1863; Atlas Ich. Indes Néerland, v. 2, p. 19, 1862.
 < *Siluridæ Proteropodes* (group *Aspredinina*) Günther Cat. Fishes B. M., v. 5, pp. 11, 12, 266, 1864.
 = *Bunocephalinæ*, C. and R. Eigenmann, Rev. S. Am. Nematognathi, pp. 9, 13, 1890.

Genera.

3. *Bunocephalus* Kner Sitzungsab. 1. Akad. Miss., [Wien], v. 17, p. 96, 1855 = *Aspredo* Swainson Nat. Hist. Fish etc., v. 1, p. 332, 1838; v. 2, p. 368, 1839.
 Type *B. verrucosus* = *Platyistacus verrucosus* Bloch.
 4. *Dysichthys* Cope Proc. Acad. Nat. Sc. Phila., 1874, p. 133.
 Type *D. coracoideus* Cope.
 5. *Bunocephalichthys* Bleeker Arch. Indici Prodr., v. 1, p. 329, 1858; Nederl. Tijdschr. Dierk., v. 1, p. 118, 1863.*
 Type *B. hypsiurus* = *Bunocephalus hypsiurus* Kner.

RELATIONSHIP.

The affinities of the *Aspredinids* to the other families of *Nematognaths* can not be positively ascertained till a study of the anatomy, and especially of the osteology, of those fishes has been made and their structural characteristics compared with those of other families. The materials for this investigation are not now at hand. The skull of *Aspredo* has been figured by Dr. C. B. Brühl in his "Osteologisches aus dem Pariser Pflanzgarten" (1856, pl. 10, figs. 1-8), and the figures given amply confirm the differentiation of the genus as the type of a peculiar family, but the details are not sufficiently given or are too ambiguous to justify any positive conclusions. No opercular bones are represented, and Professor Cope has positively denied the existence of an operculum, giving as the diagnostic characteristic of the family *Aspredinidæ*, "oper-

* The genera *Aspredinichthys* and *Bunocephalichthys*, as well as the restrictions of the previously named ones, have been generally referred (as by Günther and the Eigenmanns) to Bleeker's article published in 1863, but they were actually published with appropriate diagnoses in 1858, as indicated in the synonymy.

culum wanting." On the other hand, the contradictory statements of Valenciennes (repeated in a footnote on p. 350)* are to be considered. The superficial examination I could only make of species of the family in alcohol did not permit me to confirm the existence of any opercular bones, but nevertheless they may be present.

Meanwhile the family can be recognized by the characters given by Dr. and Mrs. Eigenmann, and another not noticed by them is also noteworthy. The intermaxillary bones, instead of being transverse, as in most nematognaths, are longitudinal, entirely distinct, parallel with each other, and carry the teeth at their posterior ends. The supramaxillaries are anterior and connected with the antero-external angle of the ethmoid. On the whole the family appears to be more nearly related to the *Argiidae*, *Loricariidae* and their admitted relatives than to the *Siluridae*. An anatomical revision of the family is, however, much needed, and any opinion formed without such an examination must be considered as purely provisional.

* There can be no vestige, however, of a suboperculum, if there are of the operculum and interoperculum.

NOTE ON THE GENUS FELICHTHYS OF SWAINSON.

BY

THEODORE GILL, M. D., PH. D.

The name *Felichthys* of Swainson has been ignored by common consent until recently. It has been lately restricted by Dr. and Mrs. Eigenmann to the auchenipterine genus called *Pseudauchenipterus* by Bleeker. This is, however, inadmissible, and if it must be used at all it is clearly to the one generally called *Elurichthys* it must be referred.

In 1838, Swainson, in "The Natural History and Classification of Fishes," etc. (vol. 1, p. 343), proposed the genus *Breviceps* for the *Silurus bagre* of Bloch and for that alone. "In this," he claimed, "the caudal fin is also lunate [as in *Synodontis*]; but the points are not extended like those of the first dorsal and pectoral rays, which reach to a very considerable length; the head is particularly short and obtuse, with the eyes very remote; and there are only two pairs of cirri, one of which is very short. The upper jaw is slightly longer than the under; it is very large, and armed with numerous sharp teeth, very small, placed in two broad rows in the upper jaw, and in one on the under; finally, the tongue is very large, thick, and rounded."

This definition (except as to the dentition*) is essentially applicable to the *Silurus bagre* although not truly diagnostic.

In 1839, Swainson, in the second volume of the same work (vol. 2, p. 189), still used the name *Breviceps* for the same genus, but in the later "general arrangement" (vol. 2, p. 305) there was substituted for *Breviceps*, "a name already used in Erpetology," a new name, *Felichthys*. The genus was redefined as having the "head short, very obtuse, depressed, anal fin lengthened; vent central; caudal forked," and two species were referred to it, (1) "*F. filamentosus*," Bl. pl. 365," and (2) "*F. nodosus*, Bl. 368, f. I."

No attention was subsequently paid to the genus. The hybrid nature of the name would be regarded by some as objectionable, and the perfect ignorance of the composer has caused many to ignore the man completely. Perfectly as I agree with those who execrate the character of his work, I must, nevertheless, agree with those others who consider that the work itself, having been duly published, must receive due attention.

*The anterior of the two rows is intermaxillary; the posterior vomero-palatine.

†*A. Felichthys filamentosus* is described as a new species in Appendix (p. 392). It is *F. marinus*.

In 1862, Dr. von Bleeker retained the name *Pimelodus* as the designation for the genus generally called *Ælurichthys*, and would have referred *Felichthys* to it as a synonym.

In 1882, Professor Swain (Proc. Acad. Nat. Sc., Phila., p. 281) proposed to use *Felichthys* as the name for the genus called in 1840 by Cuvier and Valenciennes *Auchenipterus*.

In 1888 and later, Dr. and Mrs. Eigenmann, in their excellent memoirs on the South American Nematognaths,* accepted Swainson's name *Felichthys* for the genus first defined by Bleeker, in 1862, under the name *Pseudoauchenipterus* and typified by the *Silurus nodosus* of Bloch.

The fault with all the authors cited is that they have neglected to refer to the early portions of Swainson's work. If they had done so, they would have perceived that Swainson's name should be restored to the *Silurus bagre*, and, in that case, replace the generally accepted name *Ailurichthys* or *Ælurichthys*. I presume there will be no difference of opinion as to the propriety of this course, and indeed Dr. and Mrs. Eigenmann would doubtless be the first to recognize the status. It is, therefore, desirable that the change should be made as speedily as possible.

The synonymy of the genus may be summarized as follows:

FELICHTHYS.

Synonymy.

Breviceps Swainson, Nat. Hist. Fish., etc., v. 1, pp. 328, 343 (incl. *Silurus bagre* Bl.), 1838. (Not *Breviceps* Merrem, 1820.)

Felichthys Swainson, Nat. Hist. Fish., etc., v. 2, p. 305, 1839 (substitute for *Breviceps*, but with *Silurus nodosus* Bl. added).

Ailurichthys Baird and Girard, Proc. Acad. Nat. Sc., Phila., v. 7, p. 26, 1854.

Ælurichthys Gill, Proc. Acad. Nat. Sc., Phila., 1863, p. 172, 1863. (Adopted by Günther, Steindachner, Cope, Jordan, Gilbert, Goode, Bean, et al.)

Pimelodus Bleeker, Atlas Ich. Indes Neerland, v. 2, p. 8, 1862.

Four species of the genus are known, viz:

1. F. BAGRE=*Silurus bagre* Linn, 1766.
2. F. MARINUS=*Silurus marinus* Mitchill, 1814.
3. F. PANAMENSIS=*Ælurichthys panamensis* Gill, 1863.
4. F. PINNIMACULATUS=*Ælurichthys pinnimaculatus* Steind, 1876.

SUMMARY.

- (1) The genus *Breviceps* was based solely on the *Silurus bagre* and upon the examination of an actual specimen whose dorsal and pectoral fins were illustrated.
- (2) The name *Felichthys* was formally "substituted for *Breviceps*, a name already used in Erpetology."
- (3) Inasmuch as *Felichthys* was rigorously substituted for *Breviceps*, the same species was necessarily the type of each.
- (4) The name *Felichthys* must take precedence of subsequently proposed names for the same type, e. g., *Ailurichthys* or *Ælurichthys*.

*Proc. Cal. Acad. Sc. (2), vol. 1, p. 152, 1883; Occ. Papers Cal. Acad. Sc., vol. 1, p. 285, 1890.

THE CHARACTERISTICS OF THE FAMILY OF SCATOPHAGOID FISHES.

BY
THEODORE GILL, M.D., PH.D.

The genus *Scatophagus* has been by general consent associated closely with the *Chaetodontids* and *Ephippiids* in one and the same family. Only two ichthyologists have dissented from the current view.

Bleeker, in 1859, suggested a family (*Pimelepteroidei*) subdivided into three subfamilies (*Crenidentiformes*, *Pimelepteriformes*, and *Ephippiiformes*). Under the *Ephippiiformes* were combined the genera *Ephippus*, *Drepane*, *Scatophagus*, and the extinct *Pygæus*.

Bleeker, in 1876, referred the genus *Scatophagus* (then called by him *Ephippus*) back to the "*Chaetodontoidei*," but isolated it thereunder as the representative of a subfamily "*Scatophagiformes*."

Gill, in 1883, suggested that "*Scatophagus*, judging from the figure of its skeleton (Agassiz's *Poissons Fossiles*, t. 4, pl. II, f. 1), belongs to a peculiar family, the *Scatophagida*, the ribs of which are simple and received in sockets comparatively high on the centra, and, apparently,* the posttemporal is forked. In fact, *Scatophagus* appears to have no direct affinity with the *Chaetodontids*."

The subsequent examination of a skeleton (made from a dried specimen kindly forwarded to me by William P. Selater, esq., of Calcutta) confirms the deduction from the previous consideration of the exterior of the fish combined with the figure of the skeleton. The family is quite distinct, and not even closely related to the *Chaetodontids* or *Ephippiids*. The principal characteristics are now given under (1) a super-family and (2) a family caption.

SCATOPHAGOIDEA.

Acanthopterygians with a myodome, the posttemporal bifurcate and connected by extensive suture with the cranium, the posterior process extending upwards to the supraoccipital and entering into the posterior lateral edge of the cranium, and the lateral process constituting the inferior lateral edge; lateral crests of cranium obliterated; the two ante-

* "The figure given by Professor Agassiz is ambiguous."—Original note.

rior vertebræ normal, and the foremost intimately connected with the cranium and overarched by the backward extended and nearly horizontal exoccipital condyles; the ribs sessile high up on the centra of the vertebræ or bases of the neurapophyses, and the principal epipharyngeals with the dentigerous surface expanded.

SCATOPHAGIDÆ.

Synonyms as family names.

= *Scatophagidæ*, Gill, Proc. U. S. Nat. Mus., V. 5, p. 560. 1883.

Squamipennes gen., Cuvier, Günther, *et al.*

Chatodontidæ gen., Bon., *et al.*

Pimelepteroidei gen., Bleeker, 1859.

Chatodontoidei s. f., Bleeker, 1876.

Synonym as subfamily name.

= *Scatophagiformes*, Bleeker, Arch. Neerland. Sc. exactes et Nat., t. 11, p. 302. 1876.

DESCRIPTION.

Body abbreviated, high, compressed, dorsadiform, or nuchadiform, with the breast convex, and with the contour extended backwards at the anal fin.

Anus submedian.

Scales minute, pectinate, regularly imbricated, closely adherent to the skin, and ascending on the soft portions of the dorsal and anal as well as the caudal fins, more or less covering the rays as well as the intervening membrane, and also extending on the wider surfaces of the dorsal and anal spines.

Lateralis concurrent with the back and uninterrupted.

Head small, little compressed, subrhomboid, with a high and abruptly ascending occipital crest.

Eyes in the anterior half of the head, separated by a very wide interorbital area, with the orbital margins free.

Nostrils double, in front of the eyes; those of each side moderately approximated to each other; the anterior with a small tubular extension; the posterior larger and a vertical cleft.

Mouth anterior, with the cleft nearly horizontal, little extended laterally, being mostly transverse and with a semicircular contour.

Jaws considerably modified from the normal acanthopterygian type; *intermaxillines* with short, partially consolidated and tapering branches, but not attenuated behind dentiferous area; *supramaxillines* deflected downwards behind and with a lamelliform expansion upward before the deflection; *dentaries* with flattish inferior and lateral extensions; *articular* cuneiform, between the inferior and lateral extensions of the dentary, and with the cotylus very low and posterior; *angular* mostly internal.

Teeth elongated, setiform; the shorter simple, the longer with trifold

points, in a band on each jaw; the external pleurodont or attached to the surface of the jaws.

Lips very thin on the upper jaw, obsolete on the lower.

Tongue moderate.

Suborbitals well developed; the preorbital rather high, with a free inferior margin and covering the sides, connected suturally by two processes with the palatine arch of the jaws; the succeeding bones narrow but with wide subocular expansions; the posterior connected with the preoperculum.

Opercular apparatus normally developed; *preoperculum* large and extending downwards, with a free inferior as well as posterior margin; *operculum* well developed; *suboperculum* continuous with and bordering the operculum; *interoperculum* narrow and concealed under the inferior margin of the preoperculum.

Branchiotremes ample and continuous below, but restricted in front by the branchiostegal membrane, which is broad and but slightly emarginated behind, being continuous between the rami of the jaws and confluent in front with the skin of the dentary, and separated on the sides from the preoperculum by a groove or furrow.

Branchiostegals involved in thick skin and only discernible on dissection, seven on each side.

Dorsalis divided into a longer anterior portion with ten to twelve robust heteracanth spines and a posterior shorter portion composed of branched rays.

Anal confined to the posterior half of the body, with an anterior well differentiated portion having four large heteracanth spines, and with a soft portion nearly corresponding to the soft portion of the dorsal.

Caudalis well developed, emarginated or with a nearly entire posterior margin, with fourteen branched rays, and with few raylets.

Pectorales normally inserted, rather small, with the rays branched and rapidly decreasing downwards.

Ventrales thoracic, inferior, and approximated; each with a spine and five branched rays decreasing inwards, covered on the external surface with small scales; closing at the base in a rudimentary excavation formed by folds of the skin; without any axillary appendages.

REMARKS.

The *Scatophagidae* will be thus seen to be very trenchantly separated from the *Chaetodontoidea* as well as all other families, so far as their characters are known. The *Chaetodontoidea* are well distinguished by the abbreviated anterior vertebræ and their peculiar relations, as well as by the inferior insertion of their ribs—characters reinforced by numerous others.*

* The characteristics of the *Chaetodontoidea* were indicated by the author in 1883 (Proc. U. S. Nat. Mus., v. 5, p. 559).

Professor Cope instituted a group of the percormorph fishes termed *Epilasmia*, and especially characterized by having the "second, third, and fourth superior pharyngeals transverse vertical laminae." He included therein the *Aceronuridae* (= *Teuthididae* + *Siganidae*) and *Chaetodontidae* (= *Chaetodontidae* + *Zanclidae* + *Ephippiidae* + *Platacidae* + *Toxotidae*), but did not include *Scatophagus*, nor did he elsewhere refer to it. The terms of his definition, however, would exclude the *Scatophagidae* from the *Epilasmia*, while that of the *Distegi* would apply to it.

If regard is paid to old definitions of families, no objection can be raised because the definition of one applies to it more than another. Dr. Günther's definition of the *Squamipinnes*, for example, is as applicable to some *Serranidae* as it is to some of his *Squamipinnes*. The so-called family *Squamipinnes* is indeed a thoroughly artificial group not entitled to a moment's consideration, and its long tenure of life was only possible because of the stagnation of systematic ichthyology and because naturalists were willing to accept ideas from a spirit of conservatism and without investigation. That spirit has permitted ichthyologists for many years to regard as of prime importance the extension of scales on the vertical fins in spite of the fact that the degree of such extension is most variable, and that the extension or non-extension of scales on the fins of other fishes is regarded as of slight importance.

Several assigned osteological characters need notice, as otherwise they might be considered to be indorsed.

Dr. Günther has claimed that "the centre of the first vertebra is not developed." (Cat., v. 2, p. 59.) This statement is doubtless due to the fact that the centrum of the first vertebra is so intimately united with the basioccipital that the suture appears to be obliterated. The vertebra is in fact well developed, and contrasts especially with that of the *Chaetodontoidea* by its length and position.

Dr. Günther has assigned "a recumbent spine before the dorsal pointing forwards" (Cat., v. 2, p. 58). This character has proved to be a stumbling block to one naturalist especially. Mr. Charles DeVis has distinguished two species, one from *Scatophagus argus* (named *S. quadranus*) and another from *S. multifasciatus* (named *S. ataterarians*), because the supposed new species had no procumbent spines, while the old ones had.* There is, however, no recumbent spine open to view in the typical *Scatophagi* more than in the Australian fishes. The basis of Dr. Günther's diagnosis is in the fact that the anterior interspinals have thin heads deflected forward in a spiniform manner before the dorsal fins, although in a less degree than in *Chaetodontidae*:* there is no distinctive character in this, nor is the interspinal prominent above the skin.

Dr. Günther affirms that "there are no spurious interneurals." In

* New Australian Fishes in the Queensland Museum. Part II. By Charles W. DeVis, M. A. <Proc. Linn. Soc. N. S. Wales, v. 9, pp. 453-462 (455-456), 1885.

* In *Pomacanthus paru* the interspinal has a very acute hastiform recumbent head.

the skeleton before me, there are two slender spurious interneurals (*i. e.*, interneurals having no connection with the dorsal fin) appressed to the large third interneural and, like the third, with the dorsal extremities bent forward in a spiniform manner.

Dr. Günther asserts that "the first interneural is the strongest, reclined backwards, and superiorly armed with a spine pointed forwards." It is the third interneural that is the strongest, and its dorsal extremity is pointed forward in a spiniform manner, but there is no specialized or independent spine pointed forwards, as might be inferred from the expression used.

SKELETAL ICONOGRAPHY.

The only figures of the skeleton of *Scatophagus* I know are the following:

Scatophagus argus.

Chatodon striatus Rosenthal, Ichthyotom. Tafeln, pl. 13, f. 2. 1821.
(Skel.)

Scatophagus argus, Agass., Recherches Poiss. Foss., t. 4, p. 230, pl. II, f. 1. (Skel.)

GENUS.

Only one genus, so far as known, is referable to the family *Scatophagidae*; that genus was named *Scatophagus* by Cuvier in 1830. The name *Scatophaga** having been previously (1803) given by Meigen to a genus of dipterous insects, and the two forms (*Scatophaga* and *Scatophagus*) being considered to be synonymous, a new name—*Cacodoxus*—was conferred on the Cuvieran genus by Cantor in 1850. Still later, the Cuvieran name *Ephippus* was revived by Bleeker (in 1876) for the later named *Scatophagus*, simply because the *S. argus* happened to be first named in connection with the *Ephippii*. What name, then, shall be accepted for the genus in question?

Scatophagus appears to be sufficiently distinct from *Scatophaga* (as *Picus* is from *Pica*) and therefore *Cacodoxus*, or any other new name, is unnecessary. *Ephippus* was subsequently restricted by Cuvier to the genus to which it is now universally applied, and whose typical species was at first referred to the old genus so named. Notwithstanding the fact that *S. argus* was first mentioned, the name *Ephippus* was evidently for the Ephippiids of later writers, and must be therefore retained for such. It follows that the names *Scatophagus* and *Ephippus* may be retained with their current applications. *Sargus* was not only anticipated by *Scatophagus* and *Cacodoxus*, but preoccupied in entomology and ichthyology. *Scathophagus* is merely a *lapsus calami* or typographical error.

The synonymy of *Scatophagus* may be thus summarized:

*The dipterous genus was made the type of a peculiar subfamily (*Scatophaginae*) by Desvoidy, in 1830.

SCATOPHAGUS.

Synonymy.

=*Scatophagus* Cuv. and Val. Hist. Nat. Poiss., t. 7, p. 136, 1830.

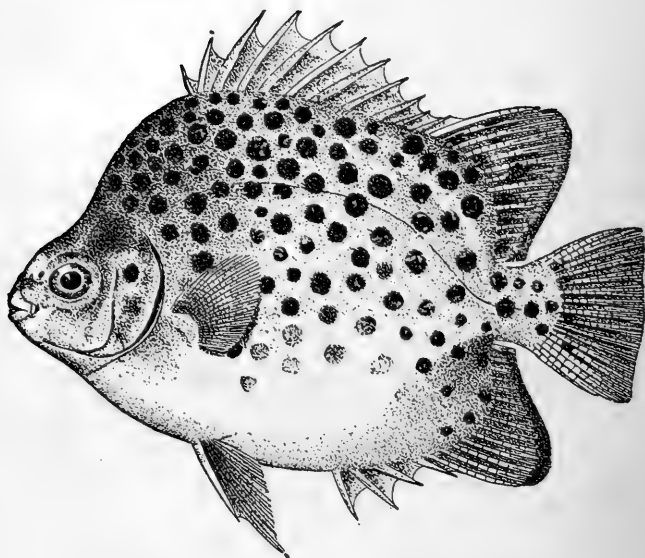
=*Cacodoxus* Cantor Cat. Mal. Fish, p. 163, 1850.

=*Sargus* Gron. Cat. Fish, p. 65, 1854.

=*Ephippus* Blkr. Arch. Neerl. Sc., t. 11, p. 302, 1876 (vix Cuv.)

=*Scathophagus* Zittel Handb. Pal., i. Abth., v. 3, p. 299, 1888.

Type *Sargus*.



Scatophagus argus.

ON THE RELATIONS OF CYCLOPTEROIDEA.

BY

THEODORE GILL, M.D., PH.D.

(With Plates XXVIII-XXX.)

By the older naturalists, *Cyclopterus* and its relatives were placed among the cartilaginous fishes. Cuvier recognized that the forms in question were true bony fishes, but placed them among the Jugular Malacopterygians and in a family to which he gave the name "Disco-boles" and with them associated the Gobiesocids and Echeneidids. More recent authors placed them among the Acanthopterygians, and Günther combined them with the *Cottidæ*, *Scombridæ* and various heterogeneous forms in the division "*Cotto-scombriformes*." None of these recognized any relation between the Cyclopteroids and the mail-cheeked fishes, although the development of a suborbital bone as a stay in *Liparididæ* was recognized long ago—among others by Pallas and Günther.

The osteological characters (not specified, however,) determined Professor Putnam to refer them to the neighborhood of the *Cottidæ*. Says Professor Putnam:

I should with Günther put the family of *Gobiesocidæ* far away, at least a suborder off, from the *Cyclopteridæ* and *Liparididæ*, which are far more closely united to the true *Cottidæ*, represented by *Cottus* and *Hemitripterus*, than to either the *Gobiesocidæ* proper or to the Gobies and Blennies. In fact *Liparis* has as close affinities, as shown by its skeleton, with *Cottus* and *Hemitripterus* as with *Cyclopterus*, and we have in the three groups represented by *Cottus*, *Liparis*, and *Cyclopterus*, well-marked families of the same suborder. The only character by which the *Cyclopteridæ* and *Liparididæ* are closely united consists in the peculiar formation of the ventral disk by the union of the ventral fins, but as this structure is simply brought about by the modification of the rays in a manner common to the several genera, and not by any marked anatomical difference in the structure of the same fins in *Cottus*, I can only look upon it as a generic character common to the known representatives of both families of *Cyclopteridæ* and *Liparididæ*, and the discovery of a representative of either family with ventral fins of the ordinary form would not necessitate the establishment of a family for its reception, as in that case we would simply consider the structure as of generic value.*

* Notes on *Liparis* and *Cyclopterus*. By F. W. Putnam. Proc. Am. Ass. Adv. Sc., v. 22, p. 337, 1874.

Acting on the determination of Professor Putnam, Professors Jordan and Gilbert, in their "Synopsis of the Fishes of North America," associated the *Cyclopteridæ* and *Liparididæ* with the true mail-cheeked fishes, remarking that "the *Chiridæ*, *Scorpenidæ*, *Cottidæ*, *Agonidæ*, *Triglidæ*, *Liparididæ* and *Cyclopteridæ* form a closely related series (*Cataphracti*), and are distinguished from all the other *Acanthopteri* by the presence of the suborbital stay." They even consider that "the relations of *Liparididæ* with the *Cottidæ* are very close and the differences of trivial value."

The examination of the skeletons and external characteristics of *Cyclopterus* and *Liparis* has led to the following conclusions:

(1) The *Cyclopteroidea* are true mail-cheeked fishes most closely related to the *Cottidæ*.

(2) The *Cyclopteridæ* and *Liparididæ* may be associated together in a peculiar superfamily—the *Cyclopteroidea*.

(3) The *Cyclopteridæ* form a peculiar family restricted to the genera *Cyclopterus*, *Eumicrotremus* and *Cyclopteroichthys*.

(4) The *Liparididæ* form another family typified by the genus *Liparis* and including also *Careproctus*, *Enantioliparis* and *Paraliparis*.

The characteristics of the superfamily *Cyclopteroidea* and the included families are herein given.

DIAGNOSIS OF CYCLOPTEROIDEA.

SUPERFAMILY CYCLOPTEROIDEA.

Synonymy.

Cyclopteroidea Gill, Cat. Fishes E. C. N. Am., p. 8 (name) 1873.

Cyclopteroidea Gill, Proc. U. S. Nat. Mus., v. 11, p. 589 (diagnosis) 1839.

Acanthopterygians with the third infraorbital bone developed as a "stay" obliquely crossing the cheek and connecting with the preoperculum, the myodome suppressed, the post-temporal bifurcate and normally connected with the cranium, the actinosts enlarged and mostly connected with the inner ridge of the proscapula, the hypercoracoid being dislodged upwards and the hypocoracoid downwards on a row with the four actinosts, ribs sessile on the vertebral centra or hæmaphyses, pharyngobranchials reduced to the large epipharyngeal (homologous with the third of typical Acanthopterygians), and ventrals modified to form a suctional disk supported by six immovable rays on each side converted into osseous tissue and without articulations; etypically suppressed.

They appear to have the branchial apparatus constructed on the same plan as in the Cottoidea; two or three *basibranchials* ossified; *hypobranchials* of three pairs in line with the corresponding *ceratobranchials* of fourth arch suppressed; *ceratobranchials* of all and *epibranchials* (of all or three) arches well developed; *pharyngobranchials* reduced to one

pair of compressed *epipharyngeals*; *hypopharyngeals* divergent and rather compressed. There are three and one-half gills, that is, double branchiæ on all the arches except the fourth which has a single row of filaments. There is no fissure behind the fourth arch.

RELATIONSHIPS.

If we now compare the *Cyclopteroidea* thus defined with other groups, it is only with those of superfamily *Cottoidea* that we find many common characters. The two groups agree with each other, and differ among themselves as follows:

Cyclopteroidea.

Third infraorbital bone developed as a "stay," obliquely crossing the cheek and connecting with the preoperculum.

Myodome suppressed.

Post-temporal bifurcate and normally connected by squamous suture with the cranium.

Actinosts enlarged and mostly connected with the inner ledge of the proscapula, the hypercoracoid being dislodged upwards and the hypocoracoid downwards on a row with the four actinosts.

Ribs sessile on the vertebral centra or hæmapophyses.

Pharyngobranchials reduced to the enlarged epipharyngeals (homogolous with the third of typical Acanthopterygians).

Ventrals modified to form a suctorial disk supported by six immovable rays on each side converted into osseous tissue and without articulations (etypically suppressed).

Cottoidea.

Myodome more or less developed.

Ventrals normally developed, entirely separate, and each composed of a spine and (1-5) articulated rays.

When it is remembered that all the characters which are common to the Cottoideans and Cyclopteroideans differentiate the Cottoideans from one or other of those families to which they have been always approximated, the importance of such an aggregate of common characters must be admitted. There can indeed be no doubt that the Cyclopteroideans are more closely related to the Cottoideans than to any other known fishes. In fact, the former differ from the latter mainly in the suppression of the myodome and the modification of the ventral apparatus. It is true that these differences are supplemented by others, but, on the other hand, the characters enumerated as common to the two are also supplemented by others. There is indeed some justification for Professor Putnam's belief that the difference between the *Liparididae* and *Cyclopteridae* are as important as those between either and the *Cottidae*. I can not, however, admit that the structure of the ventral fins is of as little importance as Professor Putnam urges.*

In view of the radical modification of the ventral rays and the whole pelvic apparatus, "the discovery of a representative of either family with ventral fins of the ordinary form" is almost inconceivable, and, if discovered, such a form would doubtless be found to have other modi-

* See *antea*, p. 361.

fications coördinate, so that "it would * * * necessitate the establishment of a family for its reception." The suppression or loss of the ventral apparatus is another matter, and might have been anticipated without violence to morphological conceptions. In reality, such a type has actually been discovered, for *Paraliparis* or *Amitra* is a form destitute of the ventral sucker and yet, as shown by its skeletal characters, is in all other respects a true Liparidid.

GEOGRAPHICAL DISTRIBUTION.

The geographical range of the *Cyclopteroidea* presents some interesting features, although accordant with those of various other families.

Dr. Günther (Introduction, p. 282, 1880,) has remarked that "the *Discoboli* of the Northern Hemisphere have likewise not penetrated to the south, where they are represented by *Gobiesocidæ*. These two families replace each other in their distribution over the globe."

The *Discoboli* (i. e. *Cyclopteridæ* and *Liparididæ*) occur in the same waters in the British seas and one or more species of *Liparididæ* have been found in the Southern Hemisphere.

Professor Putnam long ago (1873, Proc. Am. Ass. Adv. Sc., p. 310, 1874) formulated the facts representing the geographical distribution of the groups in question:

While the *Cyclopteridæ* and *Liparididæ* have their greatest development in and towards the Arctic [polar*] regions, the *Gobiesocidæ* have theirs towards the Tropics, being found throughout the tropical and temperate regions of the Pacific and Atlantic, and having but one genus, with one or two species only, extending from the Mediterranean to the British and Scandinavian coasts.†

Professor Putnam has further remarked:

The newly discovered species [*Liparis antarctica*] is, however, true to the habits of the group, and comes from the cold waters of the extreme south, while no intermediate forms have yet been found in the wide space between Eden Harbor and San Francisco, though it is probable that other species will be discovered in the cold waters of the South American coast. The representatives of the group are lovers of cold waters, as shown not only by their distribution, but by their habits; for though in the more temperate countries where they are found, as on our coast, they come to the shore in the cold winter months to leave their eggs, they afterwards retire to deeper and colder waters, and in the summer have only been taken on the coast of Massachusetts and Maine by means of the dredge.

This generalization was amply justified by the facts known when Professor Putnam formulated it sixteen years ago and has been still further fortified since.

In 1874, Professor Putnam described a Liparidid from a single specimen 1½ inches long, obtained at Eden Harbor (lat. 48° S.) as *Liparis antarctica*.

* Professor Putnam had on the previous page (339) described the *Liparis antarctica* "from Eden Harbor, about latitude 48° south," and other *Cyclopteroidea* have since been found in Antarctic waters.

† Other species of *Gobiesocidæ* extend the range of the family into the temperate waters of both the Northern and Southern Hemispheres.

The head is contained slightly more than four times in the total length, and equals the height and width of the body. The interorbital space is equal to the distance from the eye to point of the operculum. The dorsal and anal fins are covered by a thick skin anteriorly, the rays being distinctly seen only as they approach the caudal fin, to which both dorsal and anal are united. Color in life was deep yellow; in alcohol it is of a uniform light brown.*

The structure of the pectorals is not made known. Professor Putnam promised that "this species will be fully illustrated and described in the Catalogue of the Agassiz Collection of Fishes," but this great work has not yet been published.

In 1885, Prof. J. G. Fischer made known a *Liparidid* from South Georgia (54° 31 S.) under the name *Liparis Steineni*,† erroneously deeming it to be the first found of the Discoboli in antarctic waters.‡

Professor Fischer especially described the pectorals as destitute of the emargination manifest in the typical species, and the confluence of the vertical fins was also described.§

In 1888, Prof. Leon Vaillant added a third nominal species of *Liparidid* to the Antarctic fauna under the name *Enantioliparis pallidus*; the specimens described were obtained at Orange Bay, Patagonia.||

The genus *Enantioliparis* was differentiated from *Liparis* on account of the continuous vertical fins and the almost entire pectorals.** Besides the *E. pallidus*, *E. Steineni* (= *Liparis Steineni* Fischer) was recognized.

It is possible that the three species of *Liparididæ* so far found in the Antarctic Seas are merely nominal, and may be eventually ascertained to belong to one and the same species, which must then be called *Enantioliparis antarcticus*. In view of the other two *Liparidids* having the pectorals nearly entire, suspicion at least may be entertained that the species described by Putnam has the same structure, and that the describer overlooked it or deferred the description to another time.††

Another supposed cyclopteroidean of another family has been attribu-

* Notes on *Liparis* and *Cyclopterus*. By F. W. Putnam. <Proc. A. A. A. S., v. 22, p. 339, 1874.

† Über Fische von Süd-Georgien. <Jahrb. Hamburg. wissenschaft. Anst., v. 2, p. 63, 1885.

‡ Die erste in antarktischen Gewässern aufgefundene Form aus der Familie der Discoboli, in auffallender Weise mit ihren nordischen Verwandten übereinstimmend.—Fischer.

§ Eine eigentliche Einbuchtung am Rande dieser Flosse, wie bei anderen Arten, ist nicht vorhanden, doch sind die vier untersten Strahlen über die Flossenhaut hinaus verlängert, und namentlich der erst derselben reicht weit über die nächst oberen Strahlen nach hinten, wodurch allerdings der Anschein eines Einschnittes in die Hinter- rinde der Flosse entsteht.—Fischer, o. c., p. 64.

|| Mission scientifique du Cap Horn, 1882-1883. Tome VI, Zoologie—Poissons. Par Leon Vaillant, 1888 (p. C. 22).

** *Liparidibus persimilis, nisi impares pinnae continuæ sunt et radii inferiores liberi pectoralibus haud reperiuntur.*—Vaillant, o. c., p. 22.

†† The pertinence of *L. antarctica* to *Enantioliparis* has now been determined by the present writer by examination of the type.

ted to the Antarctic Seas. It is based on a sketch of a fish caught at Telly Bay, Magellan Strait, made by an officer of the mission to Cape Horn, and this sketch was supposed by Professor Vaillant to represent a species of the North Pacific cyclopteroid genus *Cyclopterichthys*—called *C. amissus*.* As the sketch has not been published, it is impossible for another to form a satisfactory opinion as to its value for determination of a species in the ichthyological system. If the ventrals are represented as forming a circular disk, the reference of the fish to the *Cyclopteridæ* may be correct, but if not, a suspicion may be entertained that the fish in question may have no close relation with the cyclopteroideans, and that it may even be, for instance, the *Neophrynichthys marmoratus*, erroneously identified with *N. latus* by Dr. Günther. At any rate the so-called *Cyclopterichthys amissus* has no real standing in the ichthyological system.

Our ignorance of the cyclopteroideans of the southern seas doubtless greatly surpasses our knowledge, but at any rate it has been definitely ascertained that the superfamily is represented there by at least one species of one genus. For further details we must wait.

It is probable that hereafter still other species will be found in the southern hemisphere, and the New Zealand naturalists would do well to institute a search for them in the southern portions of their domain.

SUBDIVISIONS OF CYCLOPTEROIDEA.

The families of the Cyclopteroideans and their subdivisions may now be considered.

CYCLOPTERIDÆ.

Synonyms as family names.

- < *Plecopteres*, Dumèril, Zoöl. Analytique, pp. 108, 109, 1806.
- < *Plecopodia*, Rafinesque, Analyse de la Nature, p. 12e fam. (includes *Cyclopterus* and "*Lepdagasterus*"), 1815.
- < *Discoboles*, Cuvier, Règne Animal, 1re éd., t. 2, p. 224, 1817; 2e éd., t. 2, p. 344, 1829.
- < *Discobola*, Latreille, Fam. Nat. du Règne An., p. 127, 1825.
- < *Cyclopteridæ*, Bonaparte, Giorn. Accad. di Scienze, v. 52, (Saggio Distrib. Metod. Animal. Vertebr. a Sangue Freddo, p. 38), 1832; Isis, 1833, col. 1201.
- < *Cyclopteridæ*, Bonaparte, Nuovi Annali delle Sci. Nat., t. 2, p. 132, 1838; t. 4, p. 193, 1840.
- < *Cyclopteridæ*, Swainson, Nat. Hist., and Class. Fishes, etc., v. 2, pp. 197, 338, 1839.
- < *Cyclopodi*, Müller, Archiv f. Naturg., 9. Jg., v. 1, p. 297, 1843.
- < *Cyclopodi*, Müller, Archiv f. Naturg., 11. Jg., v. 1, p. 130, 1845.
- < *Cyclopteridæ*, Adams, Manual Nat. Hist., p. 96, 1854.
- < *Cyclopteridæ*, Girard, Expl. and Surv. for R. R. Route to Pacific Oc., v. 10, Fishes, p. 129, 1858.
- = *Cyclopteroidei*, Bleeker, Enum. Sp. Piscium Archipel. Indico, p. xxvi, 1859.
- = *Discoboli*, Günther, Cat. Fishes Brit. Mus., v. 3, p. 154, 1861.
- = *Cyclopteridæ*, Gill, Arrangement Families Fishes, p. 5, 1872.
- < *Cyclopteri*, Fitzinger, Sitzungsber. K. Akad. der Wissensch. (Wien), B. 67, 1. Abth., p. 41, 1873.

* Vaillant, *op. cit.*, p. 33.

=*Cyclopteridæ*, Putnam, Proc. Am. Assoc. Adv. Sci., 1873, v. 22, B, p. 337, 1874.

=*Cyclopteridæ*, Collett, Norw. North Sea Exped., 1881.

=*Cyclopteridæ*, Jordan and Gilbert, Syn. Fishes N. Am., p. 744, 1882.

Synonyms as subfamily names.

<*Cyclopterini*, Bonaparte, Nuovi Annali delle Sci. Nat., t. 2, p. 132, 1838; t. 4, p. 193, 1840.

<*Discoboli*, Müller, Archiv f. Naturg., 9. Jg., v. 1, p. 279, 1843.

<*Cyclopterina*, Gill, Cat. Fishes East C. N. Amer., p. 47, 1861.

=*Cyclopterina*, Günther, Cat. Fishes Brit. Mus., v. 3, pp. 145, 1861.

=*Cyclopterina*, Gill, Proc. Acad. Nat. Sci. Phila., (v. 16), p. 189, 1864.

DIAGNOSIS.

Cyclopteroidea with a short ovate body, the abdominal cavity more than half as long as the caudi-trunk, the neural and hæmal spines much deflected backwards and mostly elongated, the interspinals mostly trending in the same direction as the vertebral spines, ribs continued on anterior caudal vertebræ, dorsalis and analis mostly confined to posterior half of body, spinous dorsalis differentiated or obsolete, cranium with the chondrocranium very extensive, and with the stay broad and expanded backwards and connecting with the inner ridge of the preoperculum.

DESCRIPTION.

Body oblong oval, inflated, and with the back typically more or less elevated and with a stout caudal peduncle.

Anus behind the middle.

Skin more or less lax, generally covered with tubercles or spines, but sometimes smooth.

Lateral line indistinct and concurrent with the back or obsolete.

Head rather short, rhombic in profile, little compressed, and covered with skin continuous with the skin of the body, and concealing all the bones, which can only be examined on dissection.

Eyes lateral, mostly in the anterior half of the head.

Nostrils double; the anterior and posterior separated by a moderate bridge.

Mouth terminal or subterminal, small, and with the cleft little oblique.

Jaws normally developed; *intermaxillines* with the ascending pedicles moderate, appressed and laminiform, separated by a shallow cleft from the compressed lateral processes.

Supramaxillines with the sella extended mesiad behind, and with the posterior limbs expanded backwards into lamelliform portions above suddenly truncated and closing in front of the styliiform or claviform portions into which the limbs are extended.

Lower jaw with a rather deep symphysis, compressed, and with the articular bone extending into a process downwards and forwards.

Teeth acute, in bands on the jaws, but none on the palate.

Lips rather thick. —

Tongue fleshy and free all around.

Suborbitals well developed, completely covered by the skin, but on dissection the third is found to be well developed, crossing the cheek and meeting the inner margin of the preoperculum.

Operculum apparatus fully developed; *Operculum* thin, with its upper and posterior portions thin but fortified by upper and lower ribs; radiating from its articular condyle are several less developed intermediate rays of ossification; *Suboperculum* with a slender portion under and below the operculum, and a larger, wider portion below the preoperculum; *Interoperculum* mostly slender, but with an expanded posterior portion.

Preoperculum with two limbs, the upper vertical and somewhat expanded downward, and the lower oblique, tending to horizontal, and with a laminar inferior or external margin.

Branchiotremes restricted to the sides; the branchiostegal membrane more or less joined to the isthmus but with a free marginal fold.

Branchiostegal rays six on each side.

Dorsalis generally double; the anterior variously developed, in the typical forms being small and mostly concealed in the grooves formed by the upraised skin and prominent tubercles of the back, in some well developed and conspicuous, in others obsolete or suppressed; the soft dorsal is behind on the posterior portion of the body and has about eight to twelve rays.

Anal similar to the second dorsal and opposite it.

Caudalis with about nine to eleven well-developed rays and few small rays above and below.

Pectorales with very broad bases procurrent below, and with numerous unbranched rays connected by continuous membrane.

Ventrals modified to form a subcircular or oval suctorial disk; the rays have the basal processes extending mesiad, appressed to the pelvic bones, and immovable; there are six in number on each side, none of which are articulated, they being mostly converted into imperfect bony tissue like the rest of the skeleton.

Branchiæ four, with the slit behind the last arch obsolete or suppressed; gill-rakers developed as slight tubercles.

SKELETON.

The skeleton of *Cyclopterus lumpus* has been noticed by Dr. Günther (Cat. Fishes B. M. v. 3 pp. 156, 157), and inasmuch as his observations disagree with the characters here assigned to the including superfamily and family, the chief discrepancies may be mentioned.

The bones of *Cyclopterus* are distinguished by the small quantity of calcareous salts deposited in them: the latter form thin lamellæ in each of the bones, and the interspaces between these layers are filled with a soft gelatinous substance which is soon dried up, so that the bones shrink together to a shapeless mass. In a fish with the bones so incompletely ossified and semimembranaceous, it is often impossible to find the sutures between them.

The chondrocranium is in great part persistent, but covered in by the bones, which are superficial and can be peeled off, the cartilage bones

coming off *almost* as well as the membrane bones. The separate bones are as well differentiated as in an ordinary fish, although certainly not readily distinguishable in a shrunken skull. In other words, the various bones are entirely distinct and do not coalesce, although from their way of overlapping and meeting, the sutures are frequently quite obscure.

The anterior portion of the infraorbital ring is well developed, and appears to be membranaceous posteriorly.

Nothing is said of the enlarged lamelliform third infraorbital or "stay," although it is very conspicuous, and developed as in the illustration herewith published.

The humerus is long, and composed of two broad lamellæ; the pectoral rays are joined to a long series of *six carpal bones*, the series extending nearly to the lower end of the humerus.

The humerus, or proscapula, is morphologically developed as in the *Cottoidea*. In the "six carpal bones" are confounded the normal number (four) and the hypercoracoid as well as hypocoracoid. In other words, there is no anomalous morphological deviation from ordinary fishes, but a close resemblance to the *Cottoidea*.

There are thirteen abdominal and fifteen caudal vertebræ ...; only the last abdominal and the first caudal vertebræ have short and feeble ribs attached to their neural spines.

In the skeleton now before me there are twenty-nine vertebræ (including the last semivertebra), which are separable into ten abdominal vertebræ and nineteen caudal—*i. e.*, bearing hæmal spines. The eighth to the twentieth bear slender ribs on their *centra near the lower edges* or on their hæmal spines.

The entire skeleton of *Cyclopterus* is so peculiar in some respects and yet morphologically so similar to that of an ordinary cottoidean fish that it would well repay a detailed and critical study. As my only object at present is to point out the characters and relations of the including groups I refrain from further notice, and indeed the want of fresh material would deter me from such a study. It may be hoped that so interesting as well as common a fish may receive attention from some one or other of the numerous zoological stations now existing in Europe. Fresh specimens are indispensable for a successful investigation of its skeleton. It is with reluctance that I submit herewith the accompanying illustrations. The skeleton figured, although preserved in alcohol, collapsed when in the artist's possession, so that the illustrations will be found to disagree with fresh specimens. The chief use of the present illustrations will be to demonstrate that the type is a true mail-cheeked fish and that there is no myodome.

The most noteworthy illustrations of the skeleton of *Cyclopterus* are three, viz:

Cyclopterus lumpus Rosenthal, Tab. Ich. (Ich. Tafeln.), pl. 19, f. 1, 1812-22.

Cyclopterus lumpus Rathke, Archiv f. Phys., v. 7, pp. 498-524, pl. 6, f. 1-4, 6 (ventrals), f. 5 (P.), f. 7 (branchiost.), f. 8-11 (vert.).

Cyclopterus lumpus Borckert, Anat.-phys. Unt. Haftscheibe C. lumpus, pp. 7-34, pl. 1 (sucker and scap. arch), 1839.

GENERA.

Three well-defined genera represent the *Cyclopteridæ*, viz :

1. *Cyclopterus* Linnæus, Syst. Nat., 10. ed., p. 260, 1758=*Lumpus* Cuv.

Type *C. lumpus* Linn.

2. *Eumicrotremus* Gill, Proc. Acad. Nat. Sc. Phila., 1864, p. 190.

Type *E. spinosus*=*Cyclopterus spinosus* Müller.

3. *Cyclopterichthys* Steind., Ich. Beitr., x, p. 14, 1881.

Type *C. ventricosus*=*Cyclopterus ventricosus* Pallas.

LIPARIDIDÆ.

Synonyms.

= *Liparididæ*, Gill, Arrangement Families Fishes, p. 4 (name), 1872.

= *Liparididæ*, Putnam, Proc. Am. Assoc. Adv. Sci. 1873, v. 22, B, p. 337 (diagnosis*), 1874.

= *Liparididæ* Collet, Norweg. North Atlantic Exped., Fishes, p. 50 (name), 1880.

= *Liparididæ* Jordan and Gilbert, Syn. Fishes N. Am., p. 738, 1882.

= *Liparidæ* Jordan, Cat. Fishes N. Am., p. 115, 1885.

Discoboles gen., Cuvier, *et al.*

Cyclopteridæ gen. Bonaparte, Günther, *et al.*

Gibiesocoidæ gen., Bleeker, 1859.

DIAGNOSIS.

Cyclopteroidea with an oblong or elongate body, the abdominal cavity very short, the neural and hæmal spines moderately deflected backwards and moderately elongated, the interspinals bent backwards from the vertebral spines, ribs not continued backwards on the caudal vertebræ, dorsalis and analis elongated and commencing forwards near the head, spinous and soft rays not segregated into distinct fins, cranium with the chondrocranium much reduced by ossification and with the stay styliform, elongated, and crossing the preoperculum to connect with its *external* margin.

DESCRIPTION.

Body elongate, antrorsiform, more or less attenuated to the caudal fin.

Scales entirely absent, the body being naked and smooth (except in males during the breeding season) and the skin more or less lax.

Lateralis obsolete.

Head moderate or rather large, covered by skin continuous with that of the body and concealing all the bones.

Eyes lateral, mostly or entirely in the anterior half of the head.

Nostrils double; the anterior and posterior separated by a narrow bridge.

* The union of the suborbital chain into one long bone reaching from the maxillary to the posterior edge of the preoperculum and the long slender ray-like interoperculum overlying the branchiostegal rays are marked characters of the *Liparididæ*. Putnam, *o. c.*, p. 338.

Mouth terminal or subterminal, with the cleft nearly horizontal.

Jaws normally developed; *intermaxillines* with the ascending processes moderate, appressed and laminiform, separated by a shallow cleft from the compressed lateral process; *supramaxillines* with the sella extended mesiad behind and with the posterior limb expanded backwards into a lamelliform portion abruptly terminating in a pointed process with an inward expansion.

Teeth acute or tricuspid, present in the jaws and sometimes on the palate.

Lips rather thick.

Tongue moderate.

Suborbitals entirely concealed by the skin, consolidated and with the third developed as a styliform stay connected behind with the outer margin of the preoperculum.

Opercular apparatus much reduced; *operculum* reduced to a bifid plate, one fork curved backwards and the other downwards and forwards on a parallel with the preoperculum; *suboperculum* a strap-like piece under the posterior fork of the operculum; *interoperculum* detached, ray-like, and appended to the lower jaw.

Preoperculum with an upper portion expanded backwards and a lower oblique bar-like portion.

Branchiotremes small and entirely confined to the sides above the pectoral axillæ, the branchiostegal membrane being continuous with the isthmus and scapular arch.

Branchiostegal rays six on each side.

Dorsalis entire, extending from near the nape backwards, with its anterior rays developed as slender spines, and the posterior simply articulated, but without external indication of the division.

*Anal*is elongate.

Caudalis supported by about eight to eleven rays without supplementary smaller ones, sometimes entirely free and in other species more or less connected with the dorsal and anal fins.

Pectorales with wide bases procurrent forwards and numerous rays, the inframedian of which are sometimes much shortened, the posterior borders being then emarginated.

Ventrals modified to form a subcircular suctorial disk; the rays have basal processes extending mesiad, appressed to the pelvic bones and immovable; there are six on each side, mostly converted into osseous tissue and not articulated.

Branchiæ three and one-half to four, with the slit behind the fourth obsolete or suppressed; *gill-rakers* moderate.

SUBDIVISIONS OF LIPARIDIDÆ.

The family of Liparidids is represented by three well-marked types which deviate from each other in characters which are generally of family value; that is, there is generally much less difference in the

character of the pectorals and in the position of the ventrals in a natural family than is manifested in the present. Therefore, I formerly suggested the isolation of the two then known into distinct subfamilies. A subsequently discovered type—*Paraliparis*—was later recognized by Jordan and Gilbert as the representative of another (*Amitrinæ*) distinguished by the want of the ventral sucker. In the so-called *Amitrinæ*, the complicated ventral sucker, so characteristic of the discobolous fishes, has entirely disappeared, but in the genus *Careproctus*, the sucker has diminished so much in size and importance as to prepare us for its disappearance in forms in which the same lines of degeneration were pushed to an extreme. *Careproctus*, in fact, is intermediate between *Liparis* and *Paraliparis* or *Amitra* in the structure of the pectorals as well as on account of the reduced ventral disk. Nevertheless, the genera of *Liparididæ* are apparently so nearly related in most details of structure and so few in number that it matters little whether subfamilies are admitted or not. If they are admitted, it will only be to bring into relief the general significance of their characters and to harmonize the family with others. The question whether it is best to retain them may await answer until the comparative anatomy of the several types is known. Meanwhile, only two subfamilies are retained, those depending on the presence or absence of the ventral sucker.

LIPARIDINÆ.

Synonymy.

- = *Liparinæ*, Gill, Cat. Fishes, E. Coast N. A., p. 47, 1861.
- = *Liparidina*, Günther, Cat. Fishes, Brit. Mus., v. 3, p. 154-158, 1861.
- = *Liparidinæ*, Gill, Acad. Nat. Sci., Phila., (v. 16.) p. 190, 1864.
- > *Liparidinæ*, Gill, Cat. Fishes, E. Coast N. A., p. 8, 1874.
- > *Careproctinæ*, Gill, Cat. Fishes, E. Coast N. A., p. 8, 1874.
- = *Liparinæ*, Jordan and Gilbert, Syn. Fishes N. Am., p. 739, 1882.
- Cyclopterini*, gen. Bonaparte.

DIAGNOSIS.

Liparididæ with a ventral sucker.

GENERA.

The subfamily is represented by the following genera:

LIPARIS.

Synonymy.

(Non-binomial.)

- = *Liparis*, Artedi, Synonymia Piscium, p. 47, 1738.
- = *Cyclogaster*, Gronov., Museum Ichthyologicum, ii, 1756; Zoophylacium, p. 55, 1763.

Binomial.

- = *Liparis*, Scopoli, Int. Hist., Nat., p. 453, 1777.
- < *Liparis*, Cuvier, Règne Animal, 1^{re} éd., t. 2, p. 227, 1817.
- < *Cyclogaster*, Girard, Expl. and Surv. for R. R. Route to Pacific Oc. v. 10, Fishes, p. 131, 1858.

- < *Liparis*, Günther, Cat. Fishes, Brit. Mus., v. 3, p. 154, 1861.
= *Liparis*, Gill, Proc. Acad. Nat. Sci. Phila., v. 16, p. 190, 1864.
> *Actinochir*, Gill, Cat. Fishes, E. Coast, N. A., p. 193, 1864 (subgenus).
> *Neoliparis*, Steindachner, Ich. Beitr., iii, p. 54, 1875 (subgenus).
Type, *L. liparis* = *Cyclopterus liparis* Linn.

CAREPROCTUS.*Synonymy.*

- = *Careproctus*, Kroyer, Naturhistorisk Tidsskrift, 3. Række, B. 1, p. 253, 1862.
= *Careproctus*, Gill, Proc. Acad. Nat. Sci. Phila., v. 16, p. 194, 1864.
Liparis, sp., Günther, etc.
Type, *C. Reinhardii* Kr.

ENANTIOLIPARIS.*Synonymy.*

- = *Enantioliparis*, Vaillant, Miss. Sc. du Cap Horn, Poissons, p. 22, 1888.
Liparis, sp., Putnam, Fischer.
Type, *E. pallidus* Vaill.

PARALIPARIDINÆ.*Synonymy.*

- = *Amitrimæ*, Jordan and Gilbert, Syn. Fishes N. Am., p. 739, 1882.
Liparidina gen Günther.

DIAGNOSIS.

Liparididæ with the ventral fins suppressed.

GENERA.

Only one genus is known, which was originally based on an injured specimen, very naturally supposed to have had a ventral disk torn off; consequently when perfect specimens were subsequently obtained Dr. Goode was prevented from identifying them with the genus, and therefore proposed a new generic name for his specimens.

PARALIPARIS.*Synonymy.*

- = *Paraliparis*, Collett, Forh. Vid. Selsk. Christiana, No. 14, p. 32, 1873; Norske Nordb. Exped., Fiske, p. 53, 1880.
= *Amitra*, Goode, Proc. U. S. Nat. Mus., v. 3, p. 478, 1881 (not *Amitrus*, Schönh.).
= *Monomitra*, Goode, Proc. U. S. Nat. Mus., v. 6, p. 109, 1884.
Type, *P. bathybi* Collett.

NOMENCLATURE OF LIPARIS.

By all authors the names *Liparis* or *Cyclogaster* have been adopted for the genus in question, the former name being attributed to Artedi by Günther, and to Linnæus by Jordan and Gilbert, while the latter has been accredited to Gronovius. A brief notice of the status of the nomenclature will be timely.

I.

Liparis was not given as a generic name by Artedi. That naturalist, after having referred the descriptions and figures of most fishes given by his predecessors to such species and genera as he supposed them to belong to, noticed in an appendix to his "Synonymia nominum" a number of fishes which he was unable to allocate. Such notices he assembled under names which had been given as specific. Among those undeterminable fishes was the one called *Liparis* by authors. The various notices were thus brought together.

"LIPARIS.

"1. LIPARIS.

"*a. Liparis nostras*, Johnson, in append. Willugh., p. 17.

"Raj., p. 74.

"Forte sequentia synonymia huc pertineant.

"*β. Liparis*, Rondel, l. 9, c. 8, p. 272.

"Gesner, p. 483.

"Aldrov., l. 3, c. 11, p. 296.

"Jonston, l. I, tit. 1, c. 2, 3, t. 1, f. 7.

"Willugh., p. 135.

"Raj., p. 74.

"*Anglis Eboracensibus & Dunelinensibus The sea-snail.*"

It is thus evident that Artedi did not use *Liparis* as a generic name. Furthermore, he was not a binomial writer.

The name *Liparis* was not used as a generic designation by Linnæus, and that naturalist referred the species so called to the genus *Cyclopterus* as *C. liparis*.

By other writers, *Liparis* has been accredited as a generic name to Cuvier, who took it up in the first edition of his "Règne Animal" (1817).

Before 1817, however (in 1810), the name *Liparis* had been used as a generic term by Ochsenheimer for a genus of lepidopterous insects. Therefore its use would have been precluded in ichthyology, had it not been given to the fish genus before.

II.

Cyclogaster was proposed as a generic name for the same fishes by Gronovius in 1763. Girard, in 1858, without giving any reasons for his course, but possibly having become cognizant of the facts about Artedi's status, used the name *Cyclogaster* in place of the generally adopted *Liparis*.

Gronovius, however, was not a binomial author, and before *Cyclogaster* was taken up by Girard, the name had been twice used by other binomial authors, viz, by Macquart for a genus of Dipters in 1834, and by Westwood for a genus of Hemipters in 1837.

III.

If we were dependent on the authors thus cited, neither *Liparis* nor *Cyclogaster* could be used for the fish genus, and the name next in succession would be *Actinochir* proposed for a section of the genus in 1864. These facts would doubtless be soon discovered by some one of the several active investigators of the literature and morphology of ichthyology, and a change might then be proposed without further knowledge. No change will be necessary, however, as in a binomial work universally overlooked, the name *Liparis* was used for the genus in question long before it was employed otherwise.

In 1777, J. A. Scopoli published an "Introductio ad historiam naturalem sistens genera Lapidum, Plantarum, et Animalium hactenus detecta," in which, among others, he defined the genera of fishes. *Liparis* was therein (p. 453) first used generically, though attributed to Artedi, and defined in the following terms:

269. LIPARIS. Arted. Aperturæ branchiales superne tantum hiantes. Membrana branch. nuda, oss. 7). Pinnæ inermes, 5); ventrali spuria, circulari, ut in *Cycloptero*.

Liparis was referred to the second "gens" of fishes characterized by the approximation of the anus to the head, the second "divisio" of the gens (*dentati*) having teeth, and the second "ordo" of the "*dentati*" having teeth in the jaws and throat. *Cyclopterus* was kept by Scopoli, as by Linnæus, in the Amphibia with chondropterygious fishes (p. 465).

It is, therefore, Scopoli who has preserved the genus *Liparis* for ichthyology. The type, of course, is the species mentioned by Artedi.

The facts in the case are summarized in the synonymy already given, (p. 372).

EXPLANATION OF PLATES.

PLATE XXVIII.

Fig. 1. *Cyclopterus lumpus* (reduced from Goode).

3. *Eumicrotremus speirosus* (reduced from Collett).

3. Scapular arch and pelvis of *Cyclopterus lumpus*, the right-hand figures representing the external surface, and the left-hand figures the internal surface of those bones (reduced from Borckert).

EXPLANATION OF LETTERS.

a. Actinosts 1-4.

hype. Hypercoracoid.

hypo. Hypocoracoid.

ic. Interscapula.

p. 1. Anterior pointed process.

p. 2. Anterior broad process.

p. 3. Lateral process.

pcl. Postclavicle.

prt. Posterotemporal.

pt. Posttemporal.

ps. Proscapula.

PLATE XXIX.

Liparis Fabricii.

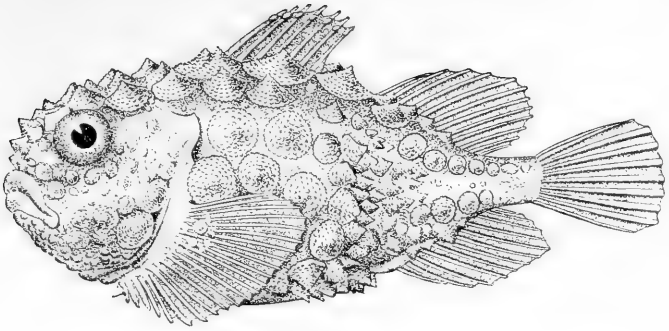
- Fig. 1. An adult individual with papillæ, and with the bases of the dorsal and anal fins concealed by adipose tissue and skin.
 2. An immature individual with color markings and with bases of the dorsal and anal fins apparent through the skin.
 3. Head, from above, of adult.
 4. Head, from below, of adult.
 5. Teeth of two individuals (*a*, *b*).
 (All reduced from Lüken's Bidragt., tab. 15, fig. 4-6).

PLATE XXX.

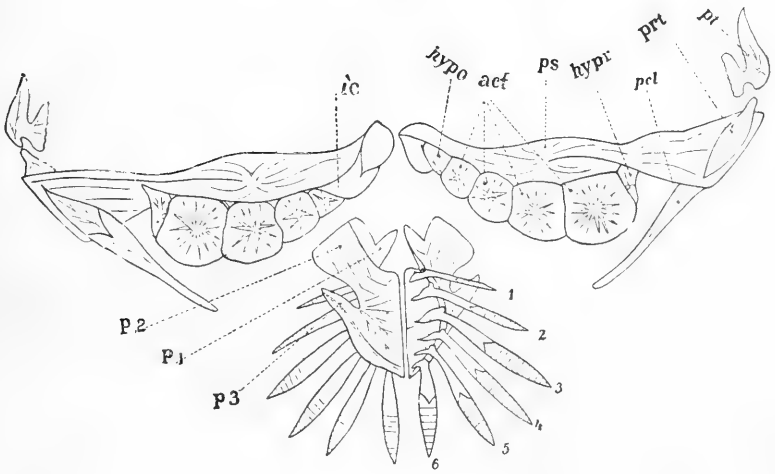
- Fig. 1. Skull and shoulder-girdle of *Cyclopterus lumpus*.
 2. Cranium of *Liparis liparis* from side.
 3. Cranium of *Liparis liparis* from above.
 4. Cranium of *Liparis liparis* from below.
 5. Cranium of *Liparis liparis* from behind.

EXPLANATIONS OF LETTERS.

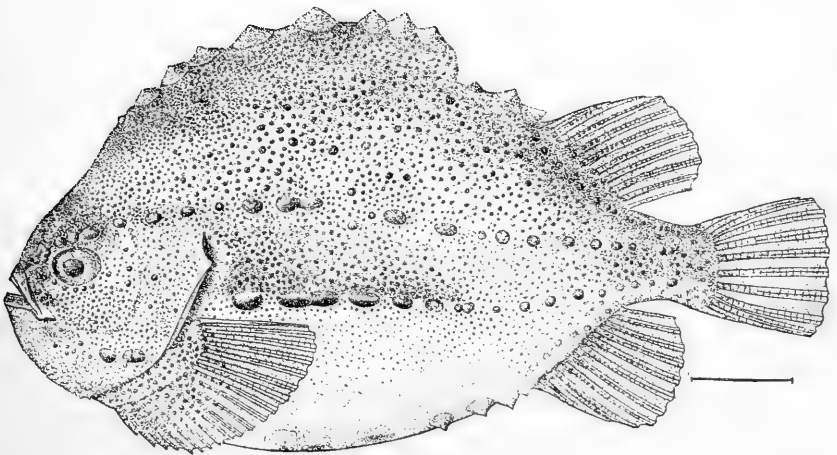
<i>a.</i>	Actinost.	<i>pcl.</i>	Postclavicle.
<i>bo.</i>	Basioccipital.	<i>pfr.</i>	Prefrontal.
<i>eo.</i>	Exoccipital.	<i>po.</i>	Preoperculum.
<i>epo.</i>	Epiotic.	<i>pro.</i>	Prootic.
<i>eth.</i>	Ethmoid.	<i>pri.</i>	Posterotemporal.
<i>fr.</i>	Frontal.	<i>ps.</i>	Parasphenoid.
<i>hym.</i>	Hyomandibular.	<i>pse.</i>	Proscapula.
<i>hypr.</i>	Hypercoræoid.	<i>pt.</i>	Post-temporal.
<i>hypo.</i>	Hypocoracoid.	<i>ptf.</i>	Postfrontal.
<i>ic.</i>	Interscapula.	<i>pto.</i>	Pterotic.
<i>io.</i>	Interoperculum.	<i>s 1, 2, 3.</i>	Suborbitals.
<i>o.</i>	Operculum.	<i>so.</i>	Suboperculum.
<i>opo.</i>	Opisthotic.	<i>so.</i>	Supraoccipital (cranium).
<i>par.</i>	Parietal.	<i>vo.</i>	Vomer.



2

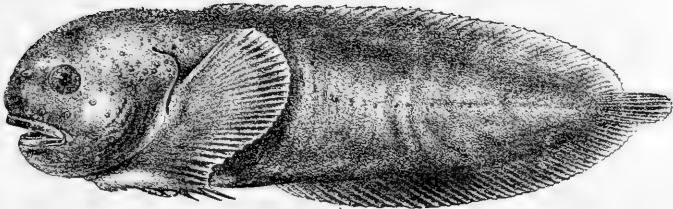
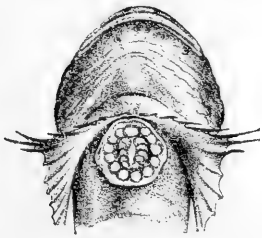
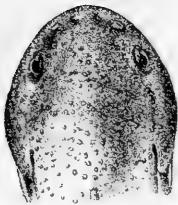
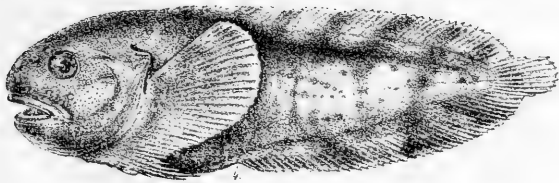


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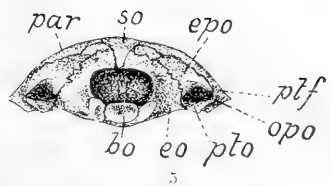
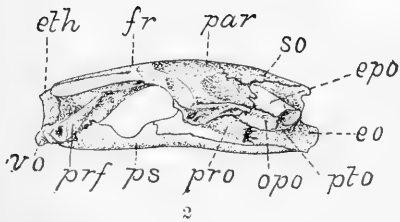
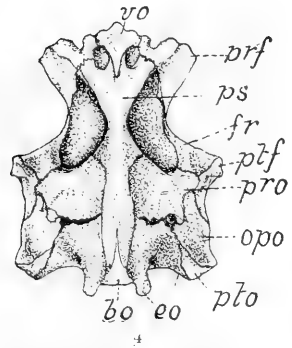
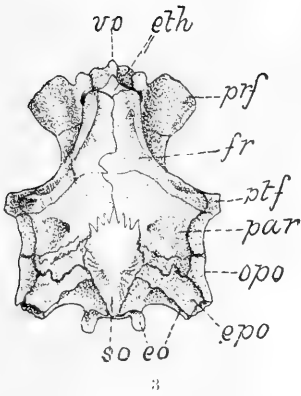
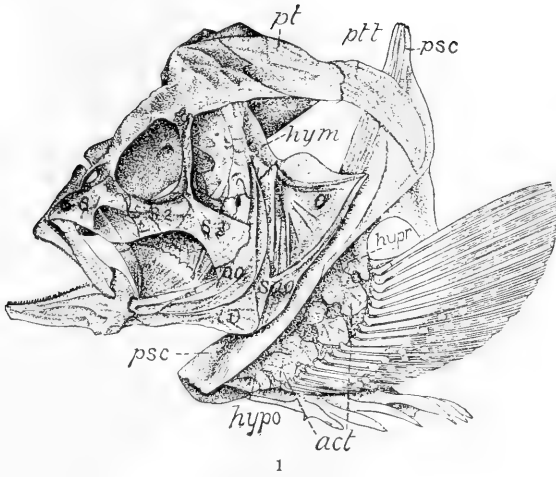


1

CYCLOPTERIDÆ.







THE OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY HEMITRIPTERIDÆ.

BY
THEODORE GILL., M. D., PH. D.

(With plate xxxi.)

Much difference of opinion has prevailed respecting the relationship of the genus *Hemitripterus* and its taxonomic rank. By the older authors it was approximated to the cottiform genera. In the "Catalogue of the Fishes of the Eastern Coast of North America" (1861, p. 42), it was referred to the family "*Cottoidæ*" as distinguished from the "*Scorpenoidæ*." Dr. Günther subsequently removed it to the family *Scorpenoidæ*. Influenced by Dr. Günther's views, I also subsequently (1865) transferred the genus to the family *Scorpenoidæ*, isolating it, however, as a subfamily type. Later (in 1872 and 1876), I elevated it to family rank and approximated it to the *Cottidæ*. By most American ichthyologists, the genus has been referred to the family *Cottidæ*. A reëxamination of the genus was undertaken to ascertain what more detailed study would indicate. The results may be formulated in three dicta:

(1) The genus *Hemitripterus* is unquestionably very closely related to the *Cottidæ*.

(2) The genus and the *Cottidæ* agree in so many respects and differ so much from others that they may be segregated in a peculiar superfamily, the *Cottoidea*.

(3) The difference between *Hemitripterus* and the other *Cottoidea* warrant the isolation of the genus in a peculiar family, the *Hemitripteriidæ*.

The detailed description of the family and the accompanying illustrations will furnish the data for judgment by others.

HEMITRIPTERIDÆ.

Synonyms as family name.

=*Hemitripteriidæ* Gill, Arrangement Family of Fishes, p. 6, 1872 (not defined).

=*Hemitripteriidæ* Gill, Johnson's New Univ. Cycl., vol. 2, p. 873, 1876 (defined).

=*Hemitripteriidæ* Gill, Standard Nat. Hist., vol. 3, p. 254, 1885 (named only).

Triplidæ gen., Bonaparte.

Cottoidei gen., Bleeker (1659).

Scorpenoidæ gen., Günther.

Cottidæ sub-fam., Jordan and Gilbert.

Synonyms as subfamily names.

Hemitripterinæ Gill, Canad. Nat., N. S., vol. 2, p. 251 (defined). 1865.

Hemitripterinæ Jordan and Gilbert, Syn. Fishes N. Am., p. 683, 1882.

DIAGNOSIS.

Cottoidea, with a dorsal consisting of a very elongate acanthopterous and short arthropterous portion, incomplete subjugular or thoracic ventrals (I, 3), inflated head with depressed crown and prominent orbits, branchial apertures confluent, but with the branchiostegal membrane broad and continuous below, with the trunk antrorsiform, the vertebrae numerous (*e. g.* 16+23), and the myodome contracted behind and otherwise peculiarly developed.

DESCRIPTION.

Body elongate and antrorsiform or slightly dosadiform, and with the anus in the anterior half of the length.

Scales replaced by spiniform or prickly dermal appendages.

Lateral line decurved from the scapular region and submedian behind.

Head moderate or small, with turgid cheeks.

Eyes mostly or entirely in the anterior half of the head.

Nostrils double, separated by a narrow bridge, nearly midway between the snout and eyes.

Mouth terminal, with the cleft little oblique or almost horizontal.

Jaws normally developed; intermaxillines with short ascending processes; supramaxillines with wide inferior margins and with the terminal portions deflected.

Teeth acute, in broad bands on the jaws and palate.

Lips thin, obsolete in front.

Tongue well developed and free all around.

Suborbitals well developed; anterior extending forwards; third crossing the cheek nearly horizontally and articulating with most of the upper half of the preoperculum.

Opercular apparatus peculiar; *operculum* moderate, inclined upwards; *suboperculum* reduced, under the operculum and produced behind it in a linguiform lobe; *interoperculum* contracted under the preoperculum, leaving a part of the branchiostegal membrane exposed.

Branchiotremes continuous below.

Branchiostegals six; two arising from the inner side of the ceratohyal and four from the outer edge of the ceratohyal and epihyal.

Dorsalis developed into two parts, a long anterior composed of slender spines and a short posterior of articulated rays; the spinous dorsal typically has a sigmoid emargination, the first spine being longest, the two succeeding gradually decreasing, and the fourth to sixth shorter than the preceding or succeeding.

Analís elongate and without spines.

Pectorales moderate, with extended procurrent bases, and with all the rays connected by membrane, the lower at least being unbranched.

Ventrals thoracic, imperfect, being composed each of a spine and three unbranched rays.

Branchiæ four, with the slit behind the last arch obsolete.

Gill rakers short, developed as two rows of dentigerous plates on three arches and one (anterior) row on the fourth.

Branchial skeleton normal (cottoidean); three *basibranchials* ossified; *hypobranchials* of three pairs in line with the *ceratobranchials* of fourth arch suppressed; *ceratobranchials* and *epibranchials* of four arches well developed; *pharyngobranchials* reduced to one pair of basin-shaped dentigerous epipharyngeals convex on the dentigerous surface and excavated in the opposite, connected with all the epibranchials; *hypopharyngeals* divergent and each with a submarginal inferior keel.

REMARKS.

Externally the Hemitriptterids are distinguishable by a peculiar physiognomy and especially by the proportions of the dorsal fin. But the chief differences which are manifested on comparison with other forms are revealed by an examination of the cranium. The principal peculiarity lies in the mode in which the floor of the cranial cavity is modified. The myodome is much contracted behind by the depression and appression of the ledge of the basioccipitine to the body of the bone and the parasphenoid and its upheaval only towards its anterior margin; the ledge from the walls of the periotics are tilted very obliquely upwards and connected with each other and the ledge of the basioccipital by broad bands of cartilage; the basioccipital is also peculiar in being surmounted in front of the exoccipitines by partitions nearly parallel but incurved about the middle and sloping outwards, these being connected by cross bars inclosing recesses, one bar being formed by an uptilted shelf of the exoccipital and an anterior one by a thin oblique uplified shelf; the lateral walls project much beyond these and terminate in trenchant edges.* A character of less importance but still noteworthy is the atrophy or suppression of the median occipital crest, which, in the *Cottidæ*, is well developed on the posterior wall of the cranium. These differences seem to be supplemented by others of minor importance but whose systematic significance can only be determined when more is known of the osteological details of the numerous genera of *Cottidæ*.

The scapular arch is typically cottoidean, the upper three enlarged actinosts articulating directly with a cartilaginous extension of the

* The relations to the soft parts of these structures can only be determined by a careful study of the soft anatomy, for which I have not the material.

proscapula, while between the fourth and the proscapula intervenes the hypocoracoid; the hypercoracoid might well be mistaken for an actinost by one unacquainted with the morphology of the skeleton, as in fact it has been in the case of *Cyclopterus* by Dr. Günther.

Only one genus is known, viz:

HEMITRIPTERUS Cuvier, Règne An., 2. ed., vol. 2, p. 164, 1829.

Type *H. americanus*=*Scorpena americana* Gmel.

PLATE XXXI.

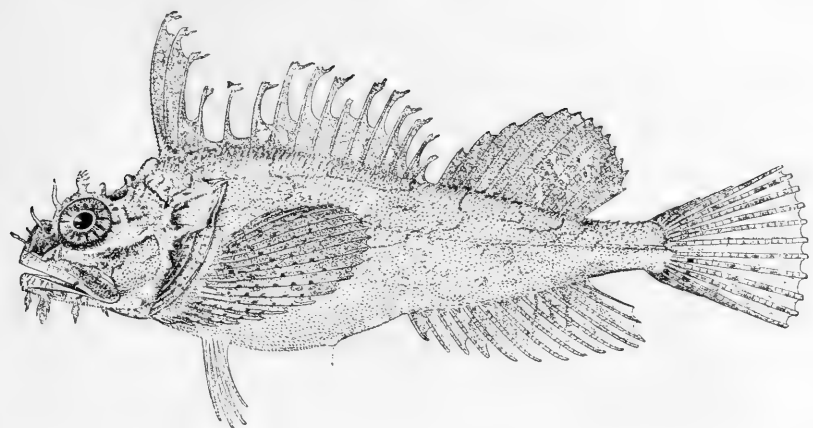
Fig. 1. *Hemitripterus americanus* (reduced from Goode).

2. Cranium from side.
3. Cranium in medisection.
4. Cranium from above.
5. Cranium from below.

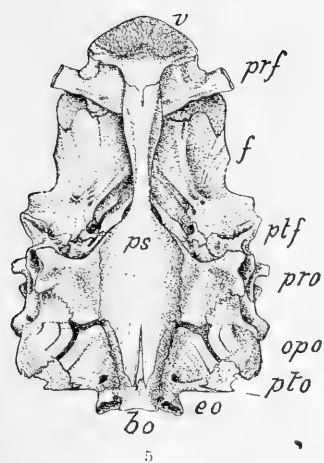
EXPLANATION OF LETTERS.

bo. Basioccipital.
eo. Exoccipital.
epo. Epiotic.
eth. Ethmoid.
fr. Frontal.
opo. Opisthotic.
par. Parietal.

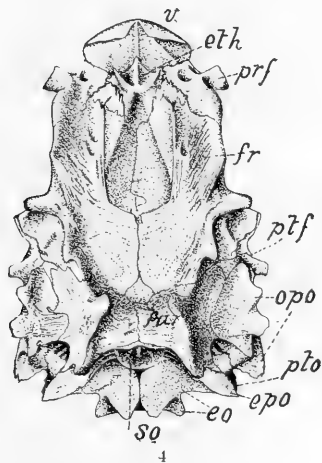
pfr. Prefrontal.
pro. Prootic.
ps. Parasphenoid.
ptf. Postfrontal.
pto. Pterotic.
so. Supraoccipital.
v. Vomer.



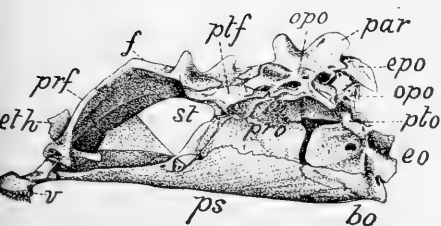
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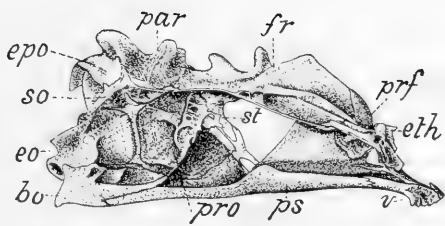
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4



2



3



PLAYING CARDS FROM JAPAN.

BY

MRS. J. KING VAN RENSSELAER.

(With plate XXXII.)

The history of playing cards, their introduction into Europe from the East by the gypsies or by the home-returning crusaders, the change and development they underwent, while being adapted, from the cards of the Orient and altered into those that are familiar to our eyes, has been dwelt upon by numbers of writers; but the cards used in Japan have not been mentioned in any of the best known histories, although they are more distinctly original than any others, and they show no marks of the common origin which the Italian, Spanish, German, French, Hindoo, and Chinese cards display.

The Japanese cards are oblong, and are made of pasteboard; the backs are painted black, with none of the checkered dotted marks which usually decorate European cards. The designs seem to be stenciled, and are brightly and appropriately colored, and then covered with an enamel or varnish, which makes them quite as slippery as our own. They are very much smaller than our cards, being a little more than 2 inches long by 1 inch broad.

Forty-nine in number, they are divided into twelve suits of four cards in each suit. One card is a trifle smaller than the rest of the pack, and has a plain white face not embellished with any distinctive emblem, and this one is used as a "joker." The other cards are covered with designs that represent that twelve flowers or other things appropriate to the weeks of the year. Each card is distinct and different from its fellows, even if bearing the same emblem, and they can be easily distinguished and classified, not only by the symbolic flowers they bear, but also by a character or letter that marks nearly every card, and which seems to denote the vegetable that represents the month. The only month that has no floral emblem is August, and that suit is marked by mountains and warm-looking skies.

January is represented by pine trees, that, on two of the cards, are shown against a lurid sky; the third one has a grayish background, that throws the trees into strong relief, and the fourth has a setting sun flecked with light clouds, the pines barely indicated in front of it, and the greater part of the card covered with the figure of a huge white bodied, red-eyed, stork.

February displays, as its emblem, a plum blossom; the four cards devoted to this month bearing its flower in various positions.

March has a red cherry blossom, and April the hanging tendrils of the wistaria vine. On one of the cards of this suit is a wee yellow-bird, which is flying across its surface under a crimson cloud.

For May there are beautiful blue Iris springing from long spiky leaves. One card shows in one of its corners part of a dock or pier, and also the water out of which the flower is lifting its lovely head.

June is represented by blood-red peonies, over one of which two yellow butterflies are hovering.

On July's cards star-shaped leaves, some yellow, some red, and some black, are scattered over their surfaces. These leaves resemble those of our "Gum" or "Liquid amber" trees, but they bear the Japanese name of Hägi. On one of the cards belonging to this suit a deer is represented standing under the branches of this strangely-hued tree. This is the only figure which recalls in anyway the emblems used on cards belonging to other nations, as on one of the Chinese cards is found either a deer or else Chinese characters which have been translated to mean "This is a deer."

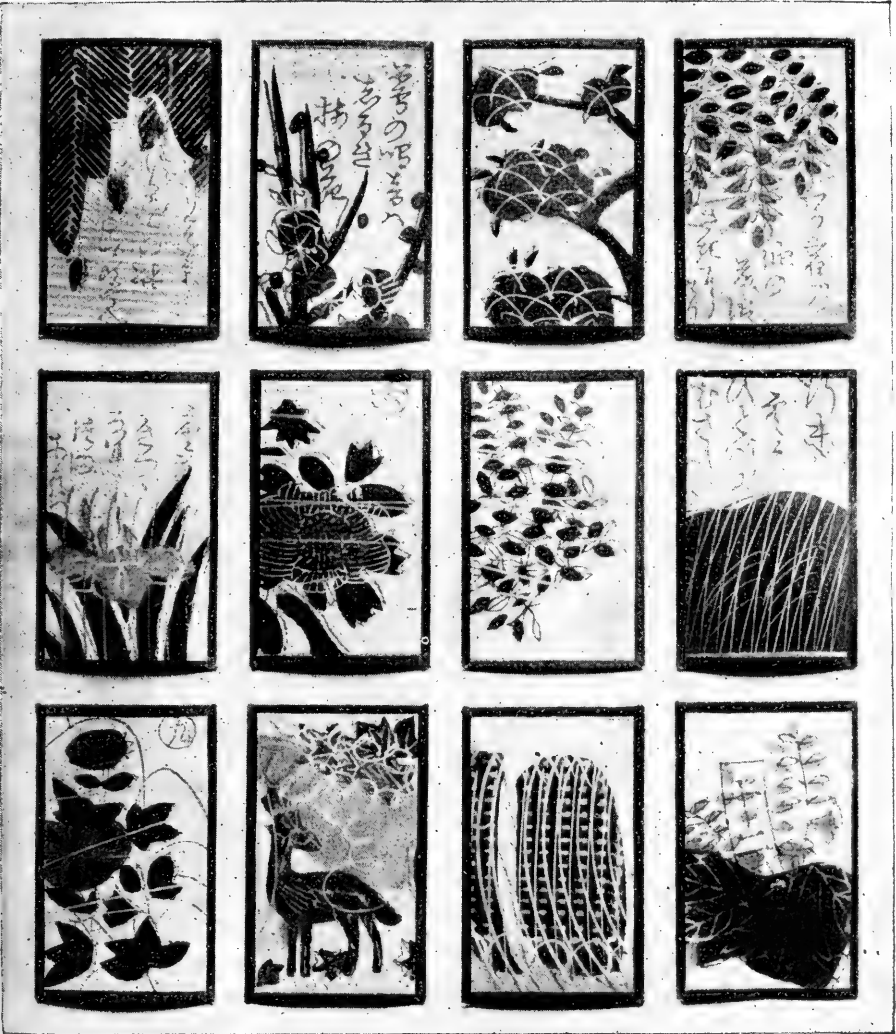
August is represented by four pictures of grass-covered mountains, in three of which they are sharply defined against a clouded blue sky, and in the fourth the sun, looking hot and sultry, beams down on a treeless hill. Three birds fly across the sky on one of these cards.

September bears the Mikado's flower, a yellow and red chrysanthemum. October, a maple tree with red or yellow leaves; and on one card is a yellow boar trotting off towards the symbolic tree.

November shows on one of its cards a willow sharply outlined against a leaden sky. The willows on a fellow-card look wind-tossed, and a long-tailed bird skims across the sky. A third card is covered with inky clouds, torrents of rain, and strange zigzags resembling forked lightning. The fourth card of this suit bears a quaint figure of a man rushing through the storm under the willow trees and dropping his sandals in his haste, his head covered with a huge yellow umbrella; streaks of lightning surround the little figure, and the storm of rain is well depicted in the picture.

December bears the imperial Japanese plant kiri, and over one of these flowers hovers a beautiful red-crested silver-winged pheasant.

An infinite variety of games are played with these cards, as there is a shade of difference in each one of each set, and in some games each has a separate value. The favorite game in Japan at the present moment is very like casino, in which any card of a set may take any other, but all have their own values in the final count.



JAPANESE PLAYING-CARDS.



NOTES ON NORTH AMERICAN MYRIAPODA OF THE FAMILY
GEOPHILIDÆ, WITH DESCRIPTIONS OF THREE GENERA.

BY

O. F. COOK AND G. N. COLLINS,
of Syracuse, New York.

(With Plates XXXIII-XXXV.)

When, in 1814, Leach erected the family *Geophilidæ*, he proposed but the one genus, *Geophilus*. From that time until 1866 thirteen genera were described, four by Newport, one by Gray, and eight by C. Koch. The characters employed by these writers were external and extremely variable, and the genera established upon them did not, for the most part, represent natural groups. The character of the work done on this family previous to 1866 may be inferred from the fact that the investigators were not sufficiently careful to count the legs accurately, at least half the species described being credited with an even number of pairs. At that date Bergsøe and Meinert published a revision of the classification of the family, and among other things announced, having counted the legs of some six hundred specimens, that the number of pairs of legs is always uneven, and since that time writers conversant with the work of these authorities have not been reporting an even number of pairs of legs. Indeed, there is no well authenticated case of a Chilopod being possessed of an even number of pairs, and Latzel * remarks in his characterization of that order:

All accounts of an even number of pairs of feet, which one can find in so many works on Myriapoda, are false, and occur either through mistakes in counting or through the fact that the last pair of feet has been separated from the others as anal appendages, and not counted with them, which is unreasonable.

But the writers on *Geophilidæ* can not be acquitted of miscounting, for if the last pair were omitted the number would invariably be even, while the earlier writers are continually mentioning species with both odd and even numbers of pairs.

American writers, with the exception of Mr. McNeill, have continued to describe species with an even number of pairs of legs, and the last paper mentioning species of this family, published during the present year, mentions *Himantarium tæniopse* as having one hundred and forty-eight pairs.

* Die Myr. d. Öst.-Ung. Monarchie, Erste Hälfte, s. 11.

The characters of the mouth parts were put forward by Bergsøe and Meinert as the principal means of separating genera, external characters being largely disregarded in generic descriptions. The genera of previous writers, with the exception of *Geophilus* Leach, *Mecistocephalus* Newport, and *Himantarium* C. Koch, were ignored. This may appear to have been a very summary method of disposing of them, but the characters on which they were based were too unimportant to have warranted their establishment in the first place, and any attempt at adapting the old names to the new classification would have resulted in wholesale confusion. Recent European writers have adopted this new classification, but as no characterization of the genera as at present defined has appeared in the English language, we have thought best to present a tabulation of the more salient characters of all the now recognized genera, as an introduction to some notes on American forms.

	Pecti- nate la- mellæ.	Den- tate la- mellæ.	Parts of la- brum.	Labrum.	Pleural pores.	Anal pores.	Jnts of anal legs.	Claw of anal feet.
<i>Mecistocephalus</i>	0	Many.	3	Free.....	Many...	1	6	0
<i>Geophilus</i>	1	0	3	Free.....	0-Many.	0-1	6	0-1
<i>Chaetechelyne</i>	1	0	(*)	(*)	Many...	0-1	6	0-1
<i>Scotophilus</i>	1	0	3	Free.....	1-Many.	0	5	0
<i>Dignathodon</i>	1	0	3	Free.....	Many...	0	5-6	0-1
<i>Stigmatogaster</i>	Many.	1	1	Free.....	Many...	0	6	0
<i>Himantarium</i>	Many.	1	1	Free.....	Many...	0	6	0
<i>Scolioplanes</i>	1	0	3	Free.....	Many...	1	6	1
<i>Bothriogaster</i>	Many.	1	1	Free (!)...	Many...	0	6	0
<i>Mesocanthus</i>	†5	0	1	Free.....	0	0	†6	0
<i>Orphnæus</i>	4-5	0	1	Free.....	0	0	†6	0
<i>Orya</i>	7-8	0	2	Coalesced.	0	0	†6	0
<i>Notiphilides</i>	4	0	1	Coalesced.	0	0	†5	0
<i>Chomatobius</i>	Many.	1	1	Free.....	Many...	0	6	1
<i>Schendyla</i> §.....	1	1	1	Coalesced.	2	0	6	0-1
<i>Pectiniunguis</i>	1	3	1	Coalesced.	2	0	6	0
<i>Escaryus</i>	1	3	1	Free||.....	Many...	1	6	1
<i>Stylolepus</i> ¶.....								

* With regard to this genus, Meinert says (Nat. Tidsskr., vii, 44): "Labrum free, entire, sinuate, armed with long hairs." Latzel (*op. cit.*, 201) expressly contradicts this statement, declaring that a labrum is not distinguishable, and that Meinert's labral hairs are on the cephalic lamina; his generic characterization is "*Labrum evanidum*."

† We tabulate them as pectinate lamellæ, out of deference to Meinert's statement (*op. cit.*, 34). In his diagram they appear to be very similar in structure and shape to the *dentate* lamellæ of *Himantarium* and its allied genera; but they do not bear any apparent resemblance to what have been called pectinate lamellæ in any other genus.

‡ In these genera the so-called "pleurae of the last segment" are not enlarged or provided with pores, and do not apparently differ from the joints of the legs. In such cases, legs with five or six joints are said to be, respectively, pseudo-six- or seven-jointed.

§ In *Schendyla eximia* Meinert the labrum is free in the middle, and the anal legs five-jointed.

|| Or slightly coalesced at the lateral angles.

¶ The description of *Stylolepus* Karsch (Troschel, Archiv. f. Naturgesch. XLVII, 9, und Taf. 1, fig. 3, a, b) is so meager as not to give even the characters covered in the tabulation. From the diagram it would appear that the prehensorial feet are more different from those of other *Geophilidæ* than the latter are from those of the other families of Chilopoda, and the configuration of the posterior segments is not less remarkable.

Meinert's terminology of parts has, with very unimportant exceptions, been used in the descriptions of genera and species; not, however, with any intention of implying that we can indorse all of the views of that writer in regard to the development of the various organs and their homologies with corresponding parts in Hexapods, in which matters he and Latzel differ so widely. But Meinert has made important contributions to the literature of the North American species, and it would seem that until these questions meet with some generally recognized settlement, the convenience arising from uniformity in descriptions should be a greater consideration for continuing Meinert's terms and methods than any advantage to be gained by changes in accordance with the momentary probability which may attach to the views of successive investigators.

While the characters drawn from the mouth parts are of most importance, it may nevertheless be occasionally convenient to separate genera without dissection. The following synoptic table is based on the least variable external characters; it is a translation from the Russian of Sseliwanoff's "*Geophilidæ museja imperatorskoi Akademii nauk*," so amended as to contain the new American genera.

1. Ventral pores in definite areas	2
not in definite areas	10
2. Antennæ short, tapering	3
filiform	7
3. Ventral pores in four areas	<i>Orphneus</i>
one central area	4
4. Anal legs pseudo-seven-jointed	<i>Mesocanthus</i>
six-jointed	5
5. Sterna without pronounced depressions	<i>Himantarium</i>
with pronounced depressions	6
6. A deep, horse-shoe-shaped depression on the anterior margin of some of the sterna	<i>Bothriogaster</i>
A deep, stigmatelike depression near lateral margin of some of the sterna	<i>Stigmatogaster</i>
7. Anal legs five-jointed	<i>Scotophilus</i>
six-jointed	8
8. Pleuræ of last segment enlarged	6
not enlarged	<i>Chaetechelyne</i>
9. Spiracle-bearing scutellum adjacent to the scutum	<i>Pectiniunguis</i>
separated from the scutum by another scutel- lum	<i>Chomatobius</i>
10. Ventral pores wanting	11
present	12
11. Claw of prehensorial feet simple at apex	<i>Escaryus</i>
divided at apex into three teeth	<i>Dignathodon</i>
12. Antennæ short, tapering	13
filiform	14
13. Anal legs six (pseudo-seven)-jointed	<i>Orya</i>
five (pseudo-six)-jointed	<i>Notiphilides</i>
14. Claw of prehensorial feet with a large tooth at base	15
unarmed, or with a small tooth	16

15. Cephalic lamina not narrowed anteriorly.....*Scolioplanes*
much narrowed anteriorly*Strigamia**
16. Cephalic lamina narrowed posteriorly.....*Mecistocephalus*
broad, narrowed anteriorly..... 17
17. Ventral pores on posterior part of sterna.....*Geophilus*
middle of sterna.....*Schendyla*

Schendyla Bergsoe and Meinert.

Nat. Tidsskr., 4 Bd., p. 103.

Body subdepressed, fusiform or elongate.

Antennæ rather short, subfiliform.

Frontal lamina coalesced; cephalic lamina not entirely covering the sides of the prehensorial feet; prebasal lamina exposed; basal lamina broad, the sides converging anteriorly.

Labrum more or less united with the frontal lamina, entire, sinuate, medianly dentate.

Mandibles with one dentate and one pectinate lamella; condylus large.

Labial sternum entire; interior labial processes conic; palpi two-jointed, the basal joint with a small process.

Claw of maxillary palpus large, simple or pectinate.

Sternum of preheusorial feet without chitinous lines, anteriorly medianly emarginate; claw with a tooth at base, or unarmed.

Scuta bisulcate, prescuta rather large.

Spiracles small, round; spiracle-bearing scutellum rather small, about half as large as the prescutellum; post scutellum large and separate; median and episternal scutella and prescutella nearly obsolete.

Ventral pores small, situated in the middle of the anterior sterna.

Pleural pores two on each side, unpigmented; last ventral plate large, triangular, obtuse, its presternum large and distinct.

Anal legs five to six jointed, enlarged in both sexes, but especially in the male, unarmed, first joint small.

Genital palpi of male simple or two-jointed.

Anal pores wanting.

Schendyla nemorensis (C. Koch).

Geophilus nemorensis C. Koch, Deutschl. Crust, etc. (1837).

Poabius bistriatus C. Koch, Syst. d. Myr., p. 183 (1847).

Linotenia nemorensis C. Koch, Die Myr., II Bd., p. 26, f. 148 (1863).

Schendyla nemorensis Bergs. et Mein., Nat. Tidssk., IV Bd., p. 105 (1866).

Geophilus tyrolensis Bergs. et Mein., *ibid.*

Body slender, yellowish or wax-colored, head light brown, sparsely pilose with short rigid hairs.

Cephalic lamina of nearly equal length and breadth; prebasal lamina scarcely visible; basal lamina nearly twice as broad as long (3:5), nearly half as long as the first scutum.

*Sseliwanoff divides *Scolioplanes* Meinert and resurrects *Strigamia* Gray for one of the divisions. The differences do not seem to us of sufficient importance to justify the separation.

Labrum entirely coalesced with frontal lamina; labral teeth 13-20.

Labial palpi with a small transparent process on the basal joint.

Claw of maxillary palpus simple.

Prehensorial feet scarcely attaining the frontal margin; sternum broader than long (8:5), longer than coxa (5:3), moderately sinuate in front, unarmed; coxa unarmed or with an obtuse tooth; claw, with a small tooth at base.

Scuta smooth, manifestly bisulcate; prescuta of moderate length, the median longest.

Spiracles small, round, smaller posteriorly.

Sterna elongate, the anterior trifoveolate, the posterior obsoletely bisulcate.

Pleuræ of last segment but little enlarged, with two large pores on each side; last sternum large, concealing the pores, its sides converging posteriorly.

Legs short and slender, the first pair scarcely shorter than the second; anal legs longer than the preceding pair, six-jointed, more strongly hirsute, enlarged in both sexes, but especially in the males, unarmed or with a very small and slender claw.

Genital palpi of male two-jointed.

Anal pores wanting.

Pairs of feet 39-47 in European specimens; Algerian specimens are recorded by Meinert with as high as fifty-five pairs; all the American specimens which we have collected have forty-one pairs.

Length, 25 millimetres and under.

HABITAT.—Clyde, New York, December, 1889, one specimen; Clyde, New York, July 1890, five specimens; Staten Island, New York, April, 1890, Dr. L. M. Underwood, three specimens.

The specimen found in December was under a board; those taken in July were in the same location, but were six or eight inches underground. The Staten Island specimens were in sandy soil among *Hepaticæ*.

The American specimens resemble, in every important particular, Swedish specimens communicated by Stuxberg to Dr. Underwood.

Meinert (*op. cit.*, 56) says that the labial palpi are simple, and Latzel (*op. cit.*, 198) declares that they are without a trace of processes, but all the specimens which we have examined, both European and American, have a process attached to the exterior edge of the basal joint of the palpus. It may be that the species varies in this regard, but we think it more probable that the writers above cited have overlooked the structure in question as it is very thin and transparent and usually lies folded close upon the dorsal side of the palpus. We have therefore modified both the generic and specific descriptions in accordance with this view. According to Meinert's description the palpus of *S. eximia* has a small process, and hence this character is common to both species of the genus.

Meinert and Latzel have both figured this species, but their diagrams show some very noticeable differences. The labrum in our specimens resembles Latzel's figure much more than that of Meinert, but the teeth are proportionally shorter, and the exterior ones are slender and appressed to the edge of the labrum.

The teeth of the dentate lamella of the mandible differ from those of Latzel's diagram in being of the same structure as their common base, and in tapering slightly toward a broad rounded apex; the arrangement of the teeth is more like that of Meinert's figure, but the teeth are not so sharp pointed, and this diagram does not represent the common base of the teeth as distinct from the mandibular stipe.

In 1872 Harger* described *Geophilus gracilis* as follows:

Very light orange, head much darker, slender, small. Cephalic segment nearly quadrate. Antennæ hairy, filiform, joints short obconic. Mandibles unarmed. Scuto-episcutal sutures distinct posteriorly. Feet pilose, 39 or 41 pairs, occasionally 40, last pair thickened and elongated. Sterno-episternal sutures distinct. Body slightly hairy throughout. Length, 15 millimeters.

This species is not uncommon under stones and rubbish in moist places about New Haven.

This description agrees with the species under discussion except in the character "mandibles unarmed." In *S. nemorensis* the claw of the prehensorial feet is armed, but the teeth vary greatly in size, and are frequently so small and so close to the base of the claw as not to be noticeable except on very close examination.

As the species was "not uncommon" it is reasonable to suppose that individuals of both sexes were under examination, but *Schendyla* is the only genus known north of Mexico to which the character "last pair of legs thickened" would apply in both sexes. That the number of pairs of feet was "occasionally forty" also corroborates our view, indicating both that several specimens were examined and that the examination was not so careful as to make it improbable that the tooth on the claw of the prehensorial feet was overlooked.

PECTINIUNGUIS Bollman.

Proc. U. S. Nat. Museum, XII, 212 (1889).

Body depressed, narrowed posteriorly.

Antennæ filiform.

Frontal lamina coalesced; cephalic lamina not covering the sides of the prehensorial feet; prebasal lamina exposed; basal lamina broad, its sides converging anteriorly.

Labrum entire, united to the frontal lamina, deeply sinuate, medianly dentate.

Mandibles with one pectinate and three dentate lamellæ.

Labial sternum entire, coalesced with the maxillary sternum, a large process attached to its exterior edge; interior labial process sharply

* Am. Journal of Science and Arts, VI, 117.

conic; palpi broadly conic, rounded, with two processes, one of which is large and attached to the exterior edge of the basal joint.

Claw of maxillary palpus broad, spoon-shaped, the concave side facing inward, margin fringed with a pectinate row of spines.

Sternum of prehensorial feet without chitinous lines, anteriorly medianly emarginate; claw unarmed at base.

Scuta bisulcate.

Spiracles long elliptic to nearly circular; spiracle-bearing scutellum of moderate size, considerably larger than the postscutellum and about half as large as the elliptical prescutellum; middle and interior scutella and prescutella present.

Ventral pores in suboval median areas.

Pleural pores two on each side, large, unpigmented.

Last ventral plate large, broad, its presternum large, undivided.

Anal legs six-jointed, all the joints well developed, enlarged in male, unarmed.

Genital palpi of male two-jointed.

Anal pores wanting.

This genus differs from *Schendyla* in the three dentate lamellæ, the coalesced labial and maxillary sterna, the large processes, the excavate claw of the maxillary palpus, and the elliptical spiracles.

On account of these and other points of difference this genus can not possibly include *Schendyla eximia* Meinert, which Mr. Bollman placed here, evidently not being aware that his genus possessed the above characters. According to Meinert's description, *eximia* differs from *nemorensis* in having the labrum free in the middle, the claw of the maxillary palpus pectinate, and the anal legs five-jointed. This last character is, by reason of its constancy in other genera, a most important one. Meinert's diagram would make it appear that the labrum is free along nearly its whole anterior margin.

In his generic characterization of *Schendyla*, Latzel gives the genital palpi as simple or two-jointed, and those of *S. nemorensis* being two-jointed, without recorded variation, we can only infer that in *eximia* they are simple. If our information and inferences are correct and well drawn, *eximia* differs from *nemorensis* in at least three particulars which are each greater than any corresponding difference known to exist between the species of any genus of the family, and there is most sufficient warrant for the elevation of Mr. Bollman's subgenus *Nannopus* to generic rank. But without specimens we can not give the question a final discussion.

Pectiniunguis Americanus Bollman.

Plate XXXIII, Figs. 1-5, and Plate XXXIV, Figs. 6-8.

Body depressed, narrowed slightly anteriorly, moderately posteriorly; brownish-yellow, with a line of medianly divided dorsal dark spots, extending from the second to the penultimate segments, after the manner of *Geophilus cephalicus*.

Antennæ with the last joint equalling in length the two preceding taken together.

Frontal lamina coalesced; cephalic lamina of equal length and breadth, anterior margin forming a semicircle, sides nearly straight, converging posteriorly, posterior margin slightly incurved; prebasal lamina exposed; basal lamina three times as broad as long.

Labrum obtusely notched at the points of support; median teeth short and blunt; those of the margins outside the sinus long and slender, closely appressed to the edge of the labrum.

Mandibles with the two dentate lamellæ next the pectinate with three teeth each, the other with two; the last is coalesced with the edge of the mandibular stipe, while the others have no chitinized connection.

Labial sternum entire, coalesced with the maxillary sternum for the middle third of its breadth; interior processes conic, coalesced on the basal portion of the exterior side with the basal joint of the palpus. This joint bears on the apical exterior angle a small process, while attached to its exterior side, and perhaps also to the labial sternum, is another process half as broad as the palpus, and nearly as long, which lies folded on the dorsal side of the palpus. To the lateral edge of the labial sternum, is attached a still larger long-oval process, folded back on the labial sternum, and reaching to the apical edge of the basal joint of the palpus. Both these large processes are of thin, transparent structure.

Prehensorial feet attaining the frontal margin of the head; sternum nearly twice as broad as long (5:3), longer than the coxa (7:5), slightly sinuate anteriorly; coxa unarmed; claw unarmed at base.

Scuta of moderate length, slightly more than twice as long as the prescuta, both becoming longer posteriorly.

Spiracles large, elliptical, longitudinal diameter of the anterior 0.095 millimetres, which is about twice the transverse; gradually smaller and rounder posteriorly, diameter of last spiracle 0.055.

Sterna bisulcate, anteriorly with a slight median foveola, which soon becomes obsolete; ventral pores in a transversely oval median area which lies nearer to the posterior margin. The anterior areas are about one-third as broad as the space between the sulcations; the areas increase in size until about the fifteenth segment, and then gradually decrease, until on the penultimate segment there are but four pores in the specimen examined.

Pleuræ of last segment moderately enlarged, pilose, with two large pores concealed under the ultimate sternum, which is very hairy and nearly twice as broad as long (7:4).

Legs with very sparse short hairs, the first pair much shorter than the second, from which the length gradually increases to beyond the middle, where it again decreases. Anal legs longest, very densely hirsute with short hairs, enlarged in the male.

Pairs of feet in the male, sixty-five; length of body 50 millimetres, width 1.55 millimetres.

This species is described from an apparently adult male collected by the *Albatross* expedition of 1887-'88, at Pichiliugue Bay, Gulf of California. Through the kindness of the curators of the department of insects of the National Museum, we have had opportunity to dissect and study the type and only specimen, No. 958.

A comparison of our description with the original of Mr. Bollman will show that we differ from him in saying that the labrum is entirely coalesced, that the claw of the maxillary palpus is excavate, that the prehensorial feet attain the frontal margin of the head, that the sterna are bisulcate, and that the specimen is a male.

The condylus in this species is very similar in shape to that of *Schendyla nemorensis*, and is correspondingly larger.

The completely coalesced condition of the labial and maxillary sterna is, as far as we have been able to ascertain, entirely unique in *Geophilidæ*. The sides of the anterior margin of the maxillary sternum are strongly defined, almost chitimized, but the margin is transparent next the coalesced portion. The coalescence is complete; no trace of a divisural line being apparent in the reticulated integument.

The only species of the family which we can suggest as having structures at all likely to be homologous with the large lateral processes of the labium is *Orya barbarica*, as figured by Meinert.

The spoon-shaped claw of the maxillary palpus, being fringed with spines all around its margin, appears to have two rows of spines until its true shape is made out.

The claws of all the feet are, like those of the maxillary palpi, excavate, or rather grooved, on the under side, and the ends of the claws appear blunt or truncate. This character is more prominent in the feet of the posterior end of the body.

Escaryus, gen. nov.

Body scarcely depressed, moderately narrowed posteriorly.

Antennæ filiform.

Frontal lamina coalesced; cephalic lamina not covering the sides of the prehensorial feet; prebasal lamina exposed; basal lamina broad, sides converging anteriorly.

Labrum entirely free, or slightly joined at the lateral angles, medianly deeply emarginate and dentate.

Mandibles with one pectinate and three dentate lamellæ; condylus present.

Labial sternum entire; interior labial processes and labial palpi obtusely conic, the latter with a small process on the basal joint.

Maxillary sternum obtusely notched in the middle, claw of maxillary palpus with an interior thin edge which is provided with one row of spines.

Sternum of prehensorial feet with chitinous lines, anteriorly scarcely emarginate; claw with a small tooth at base.

Scuta strongly convex, not sulcate.

Spiracles round, decreasing posteriorly; spiracle-bearing scutellum one-third as large as the prescutellum and about equal in size with the post and middle scutella, and between two and three times as large as the episternal scutella; episternal prescutellum very small.

Ventral pores wanting.

Pleurae of last segment with many pigmented pores; last sternum oblong, its presternum divided.

Anal legs six-jointed; armed with a large claw, sparsely clothed with long hairs; not enlarged in the female.

Anal pores present.

From *Schendyla* this genus differs in the free or nearly free labrum, the three dentate lamellæ, the chitinous lines, the ventral pores wanting, the divided presterna, the numerous pigmented pleural pores, the anal pores, and the large claw of the anal feet.

From *Pectiniunguis* it is distinct in the free or nearly free labrum, the free labial and maxillary sterna, the large processes wanting, the claw of the maxillary palpus not excavate, the chitinous lines, the round spiracles, the ventral pores wanting, the numerous pigmented pleural pores, the divided presterna, the anal pores, and the large claw of the anal feet.

The teeth of each of the dentate lamellæ are graded in size, the one toward the pectinate lamella being in every case the largest; their number varies from three to five.

The condylus is rounded conic, similar to that of *Schendyla*, but broader, its base also extending considerably beyond its sides.

The interior labial processes are not coalesced with the basal joint of the palpus, except possibly a very little at base.

The process of the basal joint of the palpus is covered with fine, hair-like papillæ.

The claw of the maxillary palpus is not fringed on the basal third, nor does the fringe extend quite to the apex. There may be other spines on the base of the claw, and not in line with the fringe. The number of hair-like spines which compose the fringe varies from three to seven, the usual number being six.

Escaryus phyllophilus, sp. nov.

Plate xxxiv, Figs. 9-11, and Pl. xxxv, Figs. 12-15.

Moderately robust, slightly attenuate anteriorly, strongly posteriorly; pale yellowish-brown; feet and body sparsely hirsute.

Antennæ of moderate length, the last joint equaling the two preceding joints taken together.

Cephalic lamina subquadrate, slightly longer than broad (13:11), the

anterior corners considerably rounded, the posterior edge slightly emarginate; basal lamina scarcely three times as broad as long.

Labrum joined at its lateral angles to the frontal lamina, anterior and posterior edges convex outwardly on each side of the middle; ends of the labrum deeply and acutely notched at the point where they meet the supports (*laminae fulciantes*). The anterior margin has two deep notches which run behind the arch of teeth. Teeth about fifteen; starting from the posterior edge of the labrum are several transverse wrinkles which run across to near the anterior edge, where there are a few long transverse wrinkles.

Mandibulary stipe with a few spines beyond the last dentate lamella, giving the appearance of another small pectinate lamella. Teeth of dentate lamellæ sharp-pointed, especially those distant from the pectinate lamella.

Prehensorial feet not reaching the frontal margin of head; sternum broader than long (9:7), nearly twice as long as coxa (7:4); anterior margin medianly broadly sinuate, with nearly obsolete concealed teeth; coxa and two succeeding joints each with an acute tooth; claw strongly curved, with a nodiform tooth at base.

Scuta not sulcate; anterior prescuta moderately long, the middle and posterior very long, except the last three.

Spiracles largest in front, 0.045 millimetres in diameter, gradually decreasing posteriorly to 0.03 millimetres.

Sterna, anterior, deeply bisulcate, and with a deep median foveola; these depressions become gradually less pronounced posteriorly. The foveola becomes obsolete on the middle segments, but shows a tendency to reappear near the end of the body.

Pleuræ of last segment moderately inflated, with about twenty-five pores, which differ much in size (0.01 to 0.04 millimetres in diameter). Last sternum narrow, oblong, the posterior angles rounded, the sides scarcely converging.

First pair of legs shorter than the second; anal legs longer than the penultimate, sparsely clothed with longer hairs, strongly decurved, as are all the legs, armed with a large claw, not enlarged in the female.

Anal pores present.

Pairs of legs in the female forty-one; length of body 32 millimetres, greatest breadth 1.3 millimetres.

Described from two females found among fallen leaves near Oakwood Cemetery, Syracuse, New York, January, 1890.

The considerable number of characters which this species has in common with *Geophilus urbicus* Meinert* makes it appear probable that that species belongs under the present genus. There is nothing to indicate that Meinert dissected the mouth parts of the single specimen in the Cambridge collection. Should our suspicion prove to be well

* Myr. Mus. Cantabrigiensis, 218.

founded, Meinert's species, as he describes it, will be distinct in the possession of the following characters:

Claw of prehensorial feet reaching beyond the frontal margin of the head.

Cephalic lamina transversely sulcate near its posterior margin.

The anterior corners of the basal lamina covered by the cephalic lamina.

The basal lamina four times broader than long.

The dorsal laminae sulcate.

The first pair of legs equal to second pair.

Anal legs shortened and thickened in the female.

Anal pores wanting.

Escaryus liber, sp. nov.

Body slender, slightly narrowed anteriorly and posteriorly, waxy white, sparsely hirsute.

Antennae of moderate length, the last joint scarcely as long as the two preceding.

Cephalic lamina considerably longer than broad (4:3), posterior corners much rounded; basal lamina more than twice as broad as long (7:3).

Labrum entirely free, the anterior and posterior margins nearly straight, subparallel except at the sinus; transverse wrinkles run from the ends to the middle. The ends notched, and two notches on the anterior margin run behind the teeth, which number about thirteen.

Mandibular stipe with one or two spines beyond the dentate lamellae. Teeth of dentate lamellae with rounded points.

Labial sternum not different from that of *E. phyllophilus*, except that the processes of the palpi are more deeply divided into papillae.

Prehensorial feet not attaining the frontal margin of the head; sternum much broader than long (3:2), longer than coxa (3:2), moderately sinuate in front, without prosternal teeth; coxa with a small, obtuse tooth, or unarmed; other joints armed; claw strongly curved, with a small, obtuse tooth at base.

Scuta not sulcate; prescuta long, increasing posteriorly, where they become more than half as long as the scuta (3:5).

Spiracles round, largest in front (0.04 millimetres), decreasing posteriorly, the last measuring 0.02 millimetres.

Sterna short in front, becoming very long caudad, bisulcate, the anterior ones medianly foveolate.

Pleurae of last segment moderately inflated, with about seventeen pores of different sizes on each side; last ventral plate narrow, oblong, the posterior corners rounded, the sides scarcely converging.

Feet gradually longer posteriorly, the first and penultimate pairs shorter than the others; anal legs slightly longer than the penultimate, armed with a large claw.

Anal pore small.

Pairs of legs in the female forty-nine; length of body 26 millimetres, greatest breadth 0.9 millimetres.

Described from one female found among leaves and rotten wood at Kirkville, Onondaga county, N. Y., April, 1890.

Pl. XXIII, Fig. 16-17.

SYRACUSE UNIVERSITY, September, 1890.

EXPLANATION OF PLATES.

PLATE XXXIII.

Pectiniunguis Americanus Bollman.

FIG. 1. Dorsal aspect of head: B, cephalic lamina; C, prebasal lamina; D, basal lamina; E, first scutum; *d*, pleura; *e*, coxa of prehensorial feet; *f*, claw of same.

FIG. 2. Ventral aspect of head, showing prehensorial feet: *a*, sternum; *b*, prosternal teeth; *d*, *e*, *f*, as in Fig. 1.

FIG. 3. Scuta, sterna and pleura of the thirty-first and thirty-second segments: L, scutum; M, prescutum; O, sternum; P, presternum; *a*, spiracle-bearing scutellum; *b*, spiracle; *c*, post-scutellum; *d*, median scutellum; *e*, episternal scutellum; *f*, pre-scutellum; *g*, median prescutellum; *h*, episternal prescutellum; *i*, anterior part of episternum; *j*, posterior part of episternum; *k, k*, parts of coxa; *l*, second joint of leg; *p*, ventral pores.

FIG. 4. Ultimate segments and anal legs, ventral view: O, penultimate sternum; P, presternum; Q, pleuræ of last segment; the pores are concealed under the ventral plate; R, last sternum; *m*, first joint of genital palpi; *n*, second joint of same.

FIG. 5. Labrum, ventral view: *b, b*, *lamine fulcrites*.

PLATE XXXIV.

Pectiniunguis Americanus (continued).

FIG. 6. Labium and maxillæ, ventral view: *a*, labial sternum; *b, b*, interior labial processes; *c*, labial palpus, basal joint; *d*, apical joint of same; *i*, small process of basal joint; *j*, large process of same; *m*, maxillary sternum; *n*, basal joint of maxillary palpus; *o*, claw of same.

FIG. 7. Labium and maxillæ, dorsal view: *k*, large process of the lateral edge of the maxillary sternum; other letters as in Fig. 6.

FIG. 8. Mandible: *a*, cardo; *b*, mandibular stipe; *c*, condylus; *d*, dentate lamellæ; *e*, pectinate lamellæ.

Escaryus phyllophilus, sp. nov.

FIG. 9. Dorsal aspect of head. Letters as in Fig. 1.

FIG. 10. Ventral aspect of head. Letters as in Fig. 2.

FIG. 11. Mandible and half of tongue (H). Other letters as in Fig. 8.

PLATE XXXV.

Escaryus phyllophilus, (continued).

FIG. 12. Scuta, sterna, and pleura of the sixth and seventh segments. Letters as in Fig. 3.

FIG. 13. Ultimate segment and anal legs, ventral view: *o*, anal pores. Other letters as in Fig. 4.

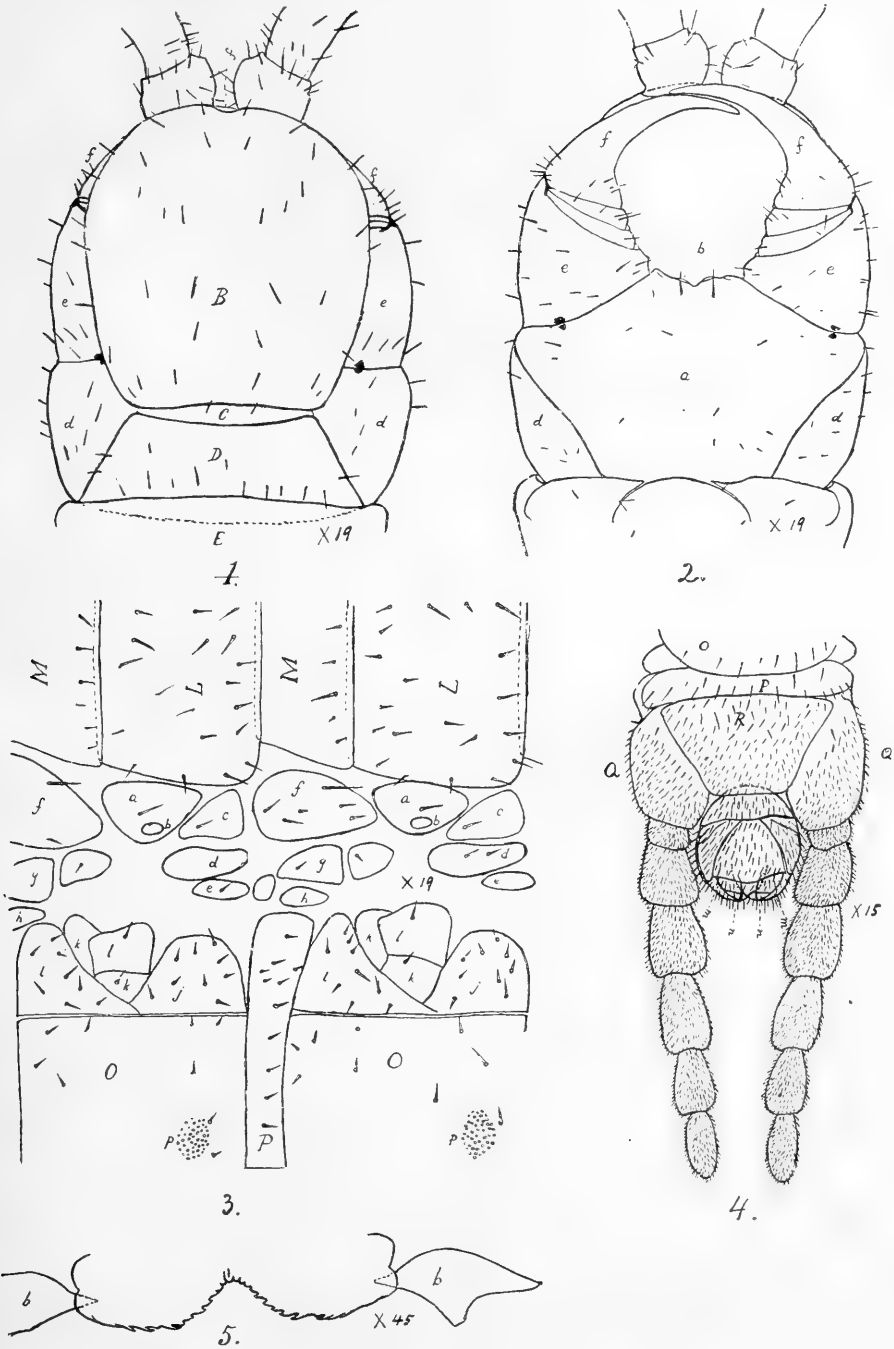
FIG. 14. Labium and maxilla, ventral view. Letters as in Fig. 6.

FIG. 15. Labrum, ventral view. Letters as in Fig. 5.

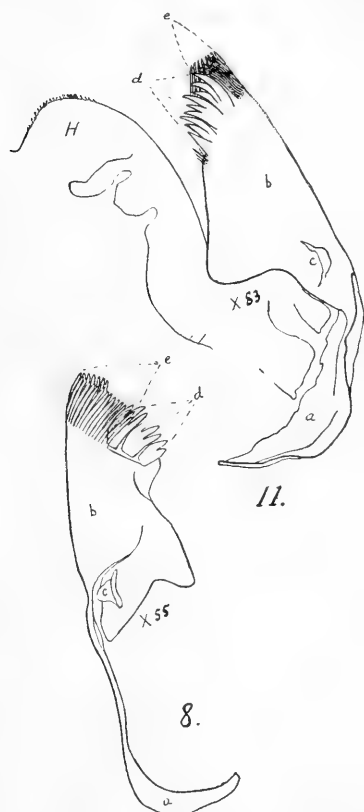
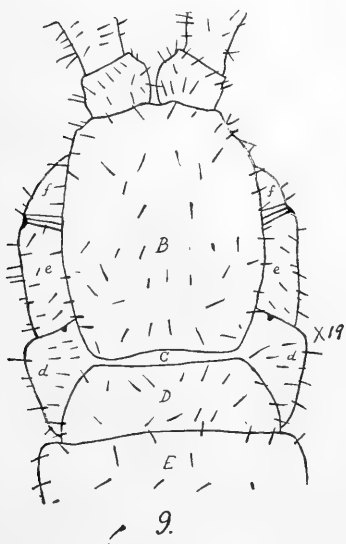
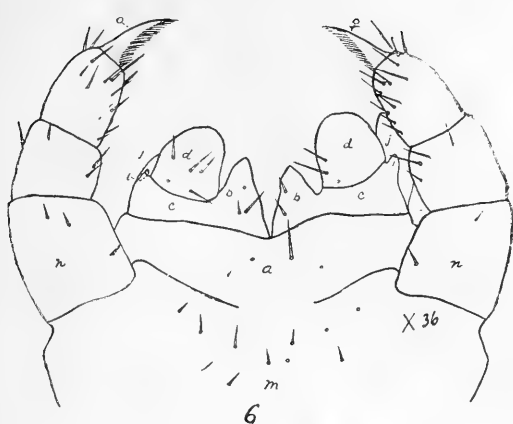
Escaryus liber, sp. nov.

FIG. 16. Ventral aspect of head. Letters as in Fig. 2.

FIG. 17. Labrum, *dorsal view*. Letters as in Fig. 5. The edge of the "Gaumenplatte" of Latzel, adhering to the dorsal side, is represented by the fringed line. The areolated integument of the head anterior to the labrum in this figure and in Fig. 15 is, of course, not confined to the amount represented. Only enough is drawn to show that labrum is free in Fig. 17, but joined to the head-integument at the anterior lateral angles in Fig. 15.



FIGS. 1-5. PECTINIUNGUIS AMERICANUS.

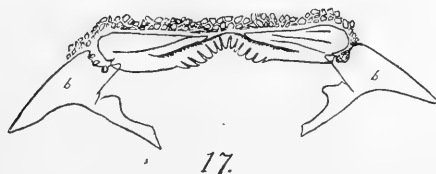
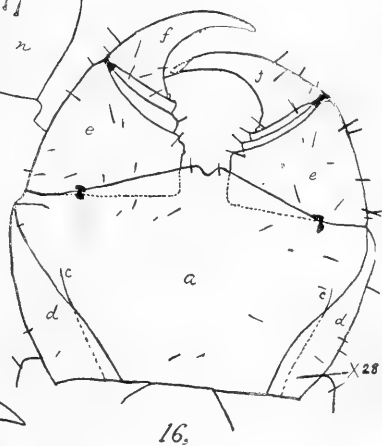
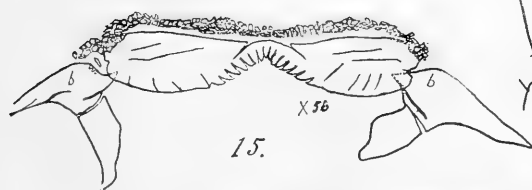
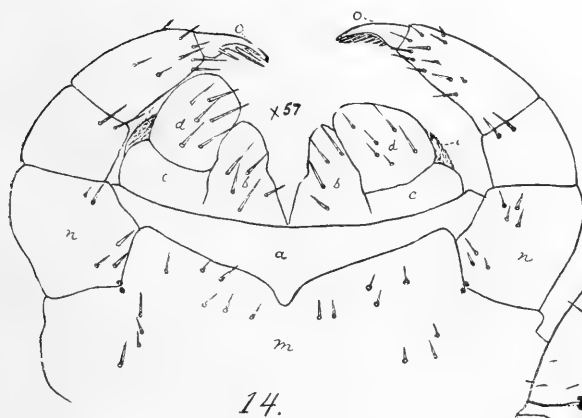
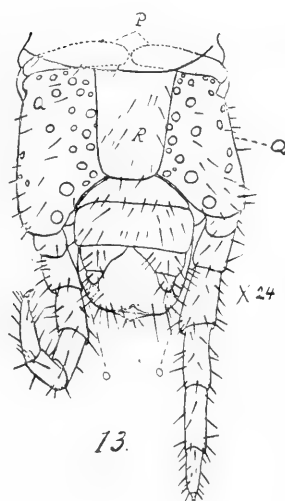
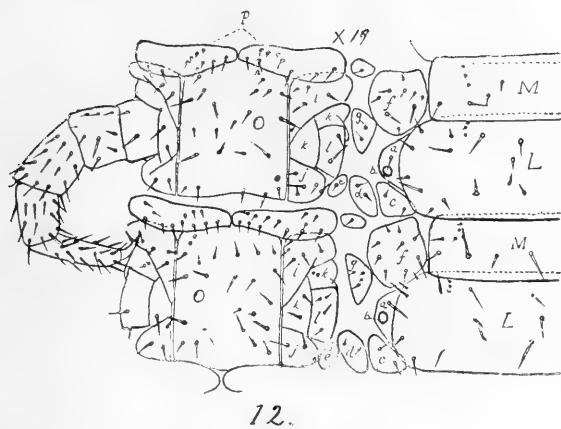


11.

FIGS. 6-8. PECTINIUNGUIS AMERICANUS.

FIGS. 9-11. ESCARYUS PHYLLOPHILUS, new species.





FIGS. 12-15. *ESCARYUS PHYLLOPHILUS*, new species.
FIGS. 16, 17. *ESCARYUS LIBER*, new species.



CONTRIBUTIONS TOWARD A MONOGRAPH OF THE NOCTUIDÆ
OF TEMPERATE NORTH AMERICA. REVISION OF HOMOHADENA,
GROTE.

BY

JOHN B. SMITH,

Professor of Entomology, Rutgers College, New Jersey.

Genus Homohadena Grt.

[1873. Bull. Buff. Soc. N. H., 1, 1890.]

Medium-sized species with the habitus of *Hadena*, but with rather distinctive maculation. Head moderate or small; front smooth; tongue strong; palpi stout, attaining middle of front. Eyes naked, with variably distinct lashes—this character becoming evanescent here. Antennæ simple, scarcely ciliate even in the male. Thoracic vestiture mixed scales and hair. Collar with crest marked but scarcely prominent. A very small, indefinite, basal thoracic tuft, vestiture else smooth. Abdomen untufted. Legs with rather long, loose hair; tibiæ unarmed, not spinose. Primaries rather elongate-trigonal, apices and outer margin slightly rounded. Ovipositor of female somewhat exerted.

The male genitalia are of the same type as in *Oncocnemis*, and this genus is its close ally, differing chiefly in the lack of the claw to fore-tibia.

The species are fuscous gray or brown, with the median lines sometimes wanting, and when present, distinct, black, and single, often connected by a longitudinal black streak or by an inward tooth from the t. p. line.

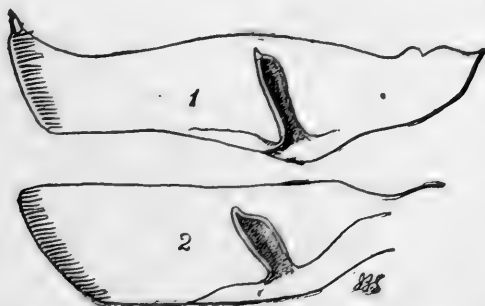


Fig. 1.—Genitalia of *H. badistriga*; 2, of *H. induta*.

The genus is very compact and the species scarcely form distinct groups, though readily separable into series on characters of macula-

tion. Some of the species are unknown to me, but all are readily placeable even into a synoptic table, from the descriptions, as the maculation is so simple.

There are three series: In the first, the median lines are wanting or punctiform; in the second, the median lines are present, but there is no basal longitudinal line; in the third, the median lines and basal dashes are all present. In all the species the ordinary spots are faint, or more usually entirely wanting.

In the first series are three species—two of them unknown to me, and they seem closely related. So far as can be made out the differences are as follows:

Incomitata has the median lines faintly indicated by venular dots; the veins are more or less evidently black marked, and there is a row of distinct terminal lunules. The color is dark fuscous or red brown. It is from Texas and not uncommon.

In *picina*, as far as I can gather from the description, the veins are not black marked and there are no terminal lunules. It is from California.

Inconstans is fuscous gray, the collar paler, the lines all lost, the veins darker in the female only. It is from Arizona.

The second series also contains three species, two of them unknown to me.

Figurata lacks the s. t. line, and the median lines are connected by an inward tooth from the t. p. line. The species is recorded from Nevada and California, and must be close to *retroversa*, in which the basal line is faint, and the s. t. marked by a pale shade only. An obscure specimen of *retroversa* might readily serve as the type of *figurata*.

Chorda is a simply marked species, the basal and median lines only distinct, the latter not in anyway connected. The s. t. line is vague, barely traceable; in color it is fuscous gray, the t. p. line nearly straight below the costal angulation. The head is white, with a black line between the antennæ.

Epipaschia is clayey gray, much shaded with black, the t. p. line widely bent, with an acute costal tooth toward base of wing. It is from New Mexico.

The third series contains six species, five of which are known to me.

Vulnerea, the only species with which I am unacquainted, differs prominently from all the others by lacking the t. a. line—a rather unusual feature.

Deserta and *induta* lack the black dash from the reniform outward. *Deserta* has the basal streak extending only to the t. a. line, while in *induta* it crosses the median space to the t. p. line. In the latter species a specimen may occasionally show a faint line over reniform, but in that case the t. a. line will suffice to distinguish it from *badistriga* with which it might else be confounded. *Induta* has the line outwardly oblique and distinctly sinuate, while in *badistriga* the line is evenly outcurved.

Retroversa and *kappa* have the ordinary spots, somewhat pale-ringed and usually rather distinct. The former is distinguished by having the t. p. line inwardly toothed at middle, the tooth extending to the t. a. line, but not beyond; basal dash very faint. The latter has the basal dash rather more distinct, becoming prominent before the t. a. line and extending through median space to t. p. line, the connection thus not formed by the tooth of the t. p. line. Of *retroversa* I know only the type.

Badistriga, the type of the genus, is as a rule paler, more grayish. The basal dash is very distinct and prominent, and the outer black streak starts from the orbicular and extends through the reniform to near the outer margin.

SYNOPSIS OF SPECIES.

Transverse lines wanting, or indicated by venular dots only.

Brownish fuscous, median lines faintly indicated.

Veins black marked; a row of terminal black lunules.....INCOMITATA.

Veins not black marked; no terminal lunules.....PICINA.

Fuscous gray, collar paler; lines all lost; veins marked in the ♀ only.INCONSTANS.

Transverse lines distinct, the t. p. at least.

Basal longitudinal streak wanting.

S. t. line wanting.

Median lines connected by an inward tooth from t. p. lineFIGURATA.

S. t. line distinct or at least traceable; median lines not connected.

Fuscous gray; t. p. line nearly straight, not as much inflected as usual.CHORDA.

Clayey gray, much shaded with black; t. p. line widely bent, with an acute costal tooth toward base of wingEPIPASCHIA.

Basal longitudinal streak present.

T. a. line obsolete.....VULNEREA.

T. a. line distinctly present.

No line from reniform outwardly, crossing t. p. line.

Basal dash extending only to t. a. line.....DESERTA.

Basal dash extending through median space to t. p. line.....INDUTA.

A black line crossing reniform, and extending outwardly across t. p. line and t. space.

T. p. line with a strong inward tooth connecting with t. a. line.RETROVERSA.

T. p. line not toothed; median lines connected by a continuation of basal streak.

Basal streak faint; the line crossing t. p. over reniform obscure, shaded; secondaries fuscous.....KAPPA.

Basal streak very distinct, as is the streak over reniform; secondaries paleBADISTRIGA.

Homohadena incommitata Harv.

1875, Harv. Buff. Bull., III, 6, *Homohadena*.

1875, Harv. Can. Ent., VII, 136, *Homohadena*.

Deep dark, somewhat fuscous brown, somewhat variable in intensity. Head and collar a richer, more reddish brown. The ordinary lines of primaries are obsolete. Median lines sometimes entirely wanting, usually traceable as a series of black venular dots. S. t. line entirely

wanting. A row of small terminal lunules; veins more or less evidently black marked. Ordinary spots wanting. Secondaries smoky outwardly, paler basally, with a variably distinct discal dot. Beneath primaries dark smoky fuscous, paler toward inner margin. Secondaries whitish powdery, most evidently so along costal and apical region. A row of outer venular dots; a discal lunule.

Expands 1.25 to 1.36 inches=31 to 34 millimetres.

HABITAT.—Texas.

An easily recognized species, distinguished by its lack of markings. It varies very little, principally in depth of ground color and in the presence or absence of the venular points. The species is common; yet unfortunately, of the numerous specimens in the accessible collections there was but a single male in which I could fully examine the genitalia. The harpes, however, are very like those of *badistrixa*, except that they lack the heavy corneous spine at upper angle of tip.

***Homohadena picina* Grt.**

1880, Grt. Can. Ent., xii, 257, *Homohadena*.

“Thorax and primaries unicolorous, dusky fuscous; the median lines indicated by venular dots, incomplete; the posterior line not as flexed as usual; fringes concolorous. Hind wings whitish at base, washed with fuscous exteriorly, the veins soiled; faint traces of a mesial line. Beneath the secondaries are paler, with a distinct dotted line. Eyes naked; body untufted; tibiae unarmed. A stout, obscurely colored and simply marked form.”

Expands 40 millimetres.

HABITAT.—California; Mr. Hy. Edwards, No. 7174.

This must be a rather close relation to that form of *fortis* which was named *vorax* by Dr. Behrens, though Mr. Grote would scarcely have called the eyes naked, and he says positively “tibiae unarmed.”

***Homohadena inconstans* Grt.**

1883 Grt. Can. Ent., xv, 28, *Homohadena*.

“Male and female. An obscure fuscous gray species with naked, lashed eyes; third palpal joint small, female ovipositor visible. Size and appearance of *induta*, but with the look of an *Agrotis* belonging to the *silens* or *lagna* group. Transverse lines all lost; stigmata wanting. In the female the veins are marked with black, the median vein most decidedly so. In the male there are no marks. The head is smoky and the collar paler. Hind wings fuscous, paler at base, and paler in the male; the veins soiled. Beneath pale and without markings; there is a faint indication of a common line which appears dotted on hind wings of female.”

HABITAT.—Arizona (Neumægen).

Unknown to me in nature.

Homohadena figurata Harvey.1875, Harv. Can. Ent., VII, 117, *Homohadena*.

"The body vestiture is scaly, mixed slightly with hairs. The size is that of *induta*. The color is more grayish than usual, and the basal streak is wanting in the specimen. The uniformly dark griseous primaries have the median lines alone visible; these are narrow, black, approximate, of the usual gothic shape, fused by a black dash below median vein. A series of terminal narrow black streaks. Fringes long, silky gray. Hind wings almost uniformly fuscous with whitish fringes, beneath paler with traces of a transverse line and a discal dot. Fore wings fuscous, with an outer line. Thorax and head like fore wings in color."

Expands 30 millimetres.

HABITAT.—Nevada; Mr. Hy. Edwards, No. 2745.

Unknown to me in nature.

Homohadena chorda Grt.1880, Grt. Can. Ent., XII, 256, *Homohadena*.

General color of thorax and primaries a warm brownish gray or fuscous. Head white, with a black line between the antennæ. T. a. line broad black, outwardly oblique, slightly irregular. T. p. line narrower, single, black, not much outcurved over cell, thence inwardly oblique, a little irregular. A broad, diffuse pale gray shade crosses the wing over the t. p. line, darkening outwardly very gradually to the fuscous terminal space. S. t. line sometimes barely traceable, sometimes preceded by a diffuse black shading. A vague median shade marked by a costal spot and scarcely definable below this. Ordinary spots obsolete, or the reniform only vague, small and pale. Secondaries whitish with soiled veins and a smoky outer border. Beneath gray, powdery, darkening outwardly, a common extra discal line.

Expands 1.25 inches=31 millimetres.

HABITAT.—Colorado; Sierra Nevada, California.

A single male from Mr. Edwards's collection is before me. It differs from the Colorado specimen described by Mr. Grote, by the greater obsolescence of the markings; the reniform, median shade, and s. t. line being almost entirely obsolete, while in the description they seem to be fairly evident, if not distinct. The white head with the broad black interantennal line is distinctive and renders the species easily recognizable. The genitalia of the male resemble those of *induta* most nearly, the clasper being apparently a little shorter, broader, and the tip a little more drawn out. The harpes differ very little.

Homohadena epipaschia Grt.1882, Grt. Proc. Kans. A. Sci., VIII, 49, *Homohadena*.

"This singular species has the look of one of the *Epipaschie*. Fore wings clayey-gray, much shaded with black; lines black, single; t. a. Proc. N. M. 90—26

somewhat curved and thick; t. p. line widely bent, with an acute costal tooth towards base of wing; s. t. line denticulate, pale, followed by prominent interspaceal black marks, the black terminal space itself cut by pale veins; fringe dark. Hind wings blackish fuscous; beneath, two bands on primaries and terminal black marks more faintly repeated; hind wings gray, with the band bent subterminally; a discal point. Above, a black cloud on center of disc, apparently separating the pale black, clouded, undefined stigmata."

Expanse 30 millimetres.

HABITAT.—Kansas.

Homohadena vulnera Grt.

1883, Grt. Can. Ent., xv, 29, *Homohadena*.

"Eyes naked, lashed; tibiæ unarmed; fore wings light brown; t. a. line obsolete; t. p. line black, single, well removed outwardly; three black median costal dots; a black dash at base below median vein; stigmata very small, inconspicuous, pale; a black dash on cell on each side of the orbicular; veins finely black at extremity, else tending to be pale; fringes checkered; thorax like fore wings; hind wings pure white; beneath with only a common dotted exterior line."

HABITAT.—Arizona. (Neumægen.)

"This species is simply marked. The eyes are plainly lashed, but in the type of the genus *H. badistriga*, after renewed examination, I am not certain that they are, though I incline to regard them lashed."

Homohadena deserta, sp. nov.

Ground color of thorax and primaries a grayish fuscous; head darker, deep brown, palpi paler; primaries with pale-gray suffusion along the costal region and accompanying the t. p. line; basal line distinct; t. a. line broad, black, evenly oblique; a narrow black longitudinal streak from base to the t. a. line; t. p. line black, narrow, single, widely out-curved over the cell, deeply incurved below; s. t. line irregular, marked by an interrupted series of paler marks in the interspaces; a series of interspaceal black lines; veins darker, marked throughout; ordinary spots evident; orbicular oval, elongate, pale ringed, else concolorous; reniform small, irregular, incompletely pale ringed; a series of black terminal lunules, and a pale line at base of fringes; a vague, diffuse, scarcely traceable median shade; secondaries white, with soiled veins and outer margin; beneath white, powdery along costal and outer margin; primaries with an incomplete outer line and discal spot; secondaries with a punctiform outer line, the points venular.

Expands 1.25 inches=31 millimetres.

HABITAT.—Colorado desert.

A single male specimen from Mr. Edwards's collection. It is easily distinguishable from all its allies by the lack of connecting streak between the median lines, and the lack of a black streak from the reniform outward.

In genital structure it resembles *badistriga*, differing in the broader harpes, lacking the stout spine at upper angle of tip, and in the still more slender clasper, the tip yet more drawn out.

Homohadena induta Harv.

1874, Harv. Buff. Bull., II, 274, *Homohadena*.

1875, Harv. Can. Ent., VII, 118, *Homohadena*.

1875, Morr. Can. Ent., VII, 91 = *retroversa*.

1875, Harv. Buff. Bull., III, 6, *an. sp. dist.*

Head, thorax, and primaries varying from fuscous gray to a dull red brown, the fuscous gray form the most common. Primaries with the ordinary lines all present. T. a. line somewhat oblique outwardly, bisinuate. T. p. line widely bent over the cell, then with a deep inward curve narrowing the median space by fully one-half. A longitudinal black streak from base through median space to the t. p. line. Ordinary spots very faint or wanting—when present, a trifle discolorous; the reniform with an indefinite paler edging. Median shade faint, very slightly darker, sometimes wanting. S. t. line pale, powdery, strongly dentate, marked by a darker preceding shade. This feature is also very variable, the line sometimes being entirely obsolete, no trace of the preceding shade being visible, while all intermediate forms are to be found. Secondaries dirty white with an indefinite outer dark border and an outer line. Also a faint discal lunule. Rarely the entire secondaries are fuscous or smoky; beneath powdery, varying from reddish to smoky fuscous, with a darker outer line not quite crossing the wing.

Expands 1.12 to 1.25 inches = 28 to 31 millimetres.

HABITAT.—Texas.

The species is rather a variable one in some features. The ground color, the median shade, the distinctness of the s. t. line—all are variable. The constant features are the course of the transverse lines and of the basal dash, and these give the species a characteristic appearance that sticks to it through all its variations. The harpes are rather broad, nearly parallel, and only slightly oblique at tip, where they are spinulose inwardly. The clasper arises from inferior margin of harpe, rather behind the middle, and is somewhat dilated toward tip, the outer angle of which is drawn out.

The species is common.

Homohadena retroversa Morr.

1874, Morr. Proc. Bost. Soc. N. H., XVII, 157, *Homohadena*.

1875, Harv. Buff. Bull., III, 6 = *kappa*.

Head, thorax, and primaries fuscous gray. Primaries with basal line marked on costa only. T. a. line very distinct, with a slight and rather even outward curve. T. p. line strongly exerted over cell, then with a long inward tooth to the t. a. line, thence forming a regular outward curve to the hind margin. The basal line is faint and narrow, as is also

the line extending through reniform and outwardly to s. t. line. S. t. line faintly marked by a slightly darker shade and the somewhat more gray terminal space. The ordinary spots are outlined by rather broad and somewhat indefinite pale rings, else concolorous. A row of small terminal lunules. Secondaries smoky, toward base paler; a smoky median line. Beneath powdery, primaries smoky, with an indefinite discal dot and a trace of an outer line on costa. Secondaries much paler, discal lunule distinct; a distinct extra discal dark line beyond which the outer margin is darker.

Expands 1.28 inches = 32 millimetres.

HABITAT.—Missouri.

Of this species I have seen the type from Mr. Tepper's collection and a specimen in Dr. Riley's possession. It is very close to *kappa*, of which Mr. Grote cites it a synonym, following Dr. Harvey's suggestion to that effect in Buff. Bull., III, 6. In addition to the differences enumerated in the general introduction, this species lacks the venular dark streaks which mark the s. t. line in *kappa*. *Figurata* Harvey must come very close to this.

Homohadena kappa Grt.

Head, thorax, and primaries varying from fuscous gray to brown. Primaries with darker shading, especially marked in the s. t. space. Basal line marked on costa only. T. a. line with a variably marked but always slight outward curve. T. p. line with a wide outward bend over discal cell, strongly incurved below, and sinuate to the hind margin. The line is followed by a distinct, though narrow pale line. S. t. line marked by a darker preceding shade, through which there is a series of interspaceal black dashes. The basal line is faint nearly to the t. a. line, then very distinct and broad to the t. p. line. The superior longitudinal dash begins between the ordinary spots, crosses the reniform and extends to the s. t. line, usually broadening out and transformed into a blackish shade. The ordinary spots are moderate, concolorous, rather indefinitely pale ringed. A series of black terminal lunules. Secondaries smoky fuscous, paler at base and with a faint median line, obscured in dark specimens. Beneath primaries dark, powdery, with traces of a discal spot and outer line. Secondaries paler, more powdery; discal spot and line distinct.

Expands 1.35 to 1.40 inches = 34 to 35 millimetres.

HABITAT.—Missouri, Iowa, Kansas, Texas.

Somewhat variable in ground color and consequent distinctness of maculation, but as a whole a very recognizable species. The differences between it and *retroversa* have been already pointed out. From *badistriga* it differs evidently by the very faint basal dash, which in the former is a prominent feature. The species is not rare, but in the museum series there is not, unfortunately, a single male with the abdomen intact, so that I can not describe the genitalia.

Homohadēna badistriga Grt.1872, Grt. Trans. Am. Ent. Soc., iv, 20, *Hadena*.1873, Grt. Buff. Bull., i, 181, *Homohadēna*.1875, Grt. Check List Noct., pl. i, f. 5, *Homohadēna*.1878, Lint. Ent. Contr., iv, 93, *Homohadēna*.

Head, thorax, and primaries varying from ashen gray to fuscous brown, collar always paler, head with a more reddish tint. T. a. line with a slight and variable outward curve. T. p. line strongly outcurved over cell, incurved but scarcely sinuate below. The basal dash is very distinct to t. a. line, somewhat narrowing beyond and rarely not attaining the t. p. line. The superior line extends usually from the t. a. line across both ordinary spots to the s. t. line, and often to the outer margin. The ordinary spots are usually somewhat darker, indefinite, rarely obsolete, sometimes with paler rings. S. t. line very variably distinct; usually it is entirely wanting, rarely it is quite definite, irregular and pale. A series of interspaceal black dashes through outer portion of s. t. space usually extending to the outer margin. Quite frequently the terminal space is somewhat darker, and the veins are white marked. In many specimens the veins are pale marked throughout, and sometimes the entire costal region is paler. A series of small terminal lunules. Secondaries varying from an almost immaculate dirty white to smoky, with base paler, often with a distinct extra discal line and discal spot. Beneath powdery, very variable in shade, with a more or less distinct discal spot and outer line.

Expands 1.12 to 1.30 inches, 28 to 33 millimetres.

HABITAT.—Maine to Texas; west to Kansas.

A decidedly variable species yet easily distinguished by the very distinct broad, black basal dash and the longer dash through the outer portion of wing. The paler collar is also a distinctive feature. The species is rather common.

The genitalia of the male are distinctive, the harpes narrow somewhat at the middle, slightly widening to the scarcely oblique tip, which is at the inner edge fringed with spinules, and has a stout, short spine at the upper angle. The clasper is long, rather slender, very slightly dilated toward tip, the outer angle acutely drawn out. The larva feeds on honeysuckle.

Homohadēna elda French, does not belong to this genus, but belongs rather to a section of *Hadena* proper as that genus is at present constituted. The genus is represented in the National Museum collection by a fair series of species, but all the forms described by Mr. Grote from the Newmøgen collection are wanting.

CONTRIBUTIONS TOWARD A MONOGRAPH OF THE NOCTUIDÆ OF
TEMPERATE NORTH AMERICA.—REVISION OF THE SPECIES OF
HADENA REFERABLE TO XYLOPHASIA AND LUPERINA.

BY

JOHN B. SMITH,

Professor of Entomology, Rutgers College, New Jersey

(With Plates XXXVI, XXXVII.)

As is the case with so many of the Noctuid genera, *Hadena* contains moths of quite diverse habitus and structure and which can not remain associated under the same name. Since I originally prepared the revision of the entire genus, considerable new material has come to hand, principally in those groups which are not typical, strictly. Of the forms referable to *Xylophasia* and *Luperina*, I have nearly all the species, and as they are conveniently separable from the balance of the series I have concluded to present *Hadena* in fragmentary form, premising that I believe that the genus will be eventually restricted to the species here treated, and possibly *Luperina* or *Xylophasia* may take generic rank. In its broad sense *Hadena* contains moths of small to large size, normal noctuid maculation usually present. Eyes naked; front smooth; antennæ variable, but usually not pectinated or brush-like; palpi stout, reaching middle of front; tongue long and strong, spiral; legs stout, tibiæ unarmed; thorax with divided crest; abdomen with dorsal and lateral tufts; primaries long and narrow to broad and short, apices rounded to apices acute. The genitalia are also various, and taking the genus as a whole there is no agreement. Taking the extremes, there is very little indeed to suggest generic identity between *cuculiformis* and *turbulenta*, and no scientific end can be gained by holding together such an unnatural association. The genital structure of the male affords a convenient basis for division, those species treated here all agreeing in having the harpes abruptly modified into a trigonate tip, set almost at right angles to the harpe, and inside of this bearing a single corneous clasper of variable length, supplemented in some cases by small secondary claspers attached to the harpes nearer to base. The species are all of good size, the tuftings are distinct, and the habitus reveals the relationship at a glance. The difference between *Luperina* and *Xylophasia* is in the abdominal tufting, that of *Luperina* being loose

- and confined to the basal segments, the abdomen and body also more cylindric, while in the others the tufts are definite, distinct, truncate bunches of hair, the abdomen and body more depressed or flattened, less cylindric. There is a general agreement in the sexual characters of the male, with one serious exception only. *L. stipata* Morr., while otherwise perfectly agreeing with *loculata* and others, is thoroughly aberrant in genital characters, and forms a solitary exception to an otherwise uniform tendency.

For present convenience the species of *Luperina* will be treated first, and to this subgenus must be referred those species which in the characters of *Hadena* lack the distinct tufts of the abdomen, which becomes also more cylindric and plump in both sexes. The thoracic tuftings are reduced in size, the vestiture is more smooth and scaly, and the thorax itself seems shorter.

The species are readily distinguished :

Burgessi—of which *Hadena discors* is a synonym—and *longula* are dark gray species with a narrow black streak connecting the median lines.

Burgessi has white secondaries, the outer margin narrowly dusky, and the primaries are rather narrow. The clasper is long and slender, somewhat thickened toward the middle.

Longula is decidedly broader winged with essentially the same markings as the preceding ; but the secondaries are dusky and the clasper of the male is much shorter and thicker.

Passer Gn (*loculata* Morr.) is readily distinguished by the even brown color, more or less verging to gray, and the prominent black claviform, the ordinary spots also more or less distinctly black ringed. The primaries are rather broader, with obtuse, somewhat rounded apices. The genitalia of the ♂ lack the clasper, and the tip of harpes is rather narrower than usual, with a dense brush of spinules inferiorly. *Conspicua* is an aberration rather than a variety, and is distinguished by a paler, rather red, color, with a dusky suffusion over the cell, the lines distinct, and a distinct black shade before the s. t. line.

Niveivenosa is readily distinguished by the white marked veins, giving it a deceptive resemblance to certain species of the *quadridentata* group of *Agrotis* (*Carneades*), which misled Mr. Grote in his generic reference of the species. I have seen no male.

Stipata has the median vein and its forks at end of cell white to the t. p. line, and a heavy black shade through median space, easily defining the species. In genital structure the species is aberrant. The harpes are broad, rather even, the superior margin thickened, more chitinous and obtusely prolonged, while from the inner side, just within the tip, they give rise to two small acute processes which are corneous. The relationship of this form is obscure ; but I can not find a more satisfactory position for it at present.

In synoptic form the species separate as follows :

All the veins white marked	NIVEIVENOSA.
Median vein and branches to t. p. line white marked ; a heavy black line or shade connecting the median lines	STIPATA
None of the veins white.	
No connecting line between median lines.	
Color brown to grayish brown ; claviform distinct, black, ordinary spots black marked.	PASSER
A narrow black line connecting the median lines.	
Secondaries white, with a narrow dusky margin	BURGESSI
Secondaries dusky	LONGULA

The species of *Xylophasia* are much more numerous and separate readily into groups or series which may be typified by some of the more common species. The groups will be roughly defined here, and under separate headings the species will be described.

Group *vultuosa* is readily recognizable by the character of the markings in the terminal and subterminal space. The former is darker and sends into the s. t. space two spurs, giving the whole the appearance of two triangular dark shades. The median lines are incomplete or punctiform.

Group *finitima* has a more even ground color, the median lines distinct, while the s. t. line is indefinite or obsolete, and there is no trace of the triangular dark patches.

Group *sputatrix* contains species in which the transverse lines are obsolete or only traceable, never distinct, while the reniform and sometimes the orbicular are white marked, blotchy.

Group *devastatrix* has the transverse maculation distinct, the terminal space concolorous or paler, never darker ; s. t. lines preceded by a series of sagittate black spots which are sometimes confluent.

Group *alticola* is represented by an evenly colored species in which all the maculation is distinct on an even ground not emphasized by darker shadings.

Group *arctica* has also the transverse maculation distinct, but the s. t. space is paler than the median or terminal space, and the latter is darkest. The s. t. line is sometimes preceded by a darker shade, but never by sagittate spots. As compared with the preceding the species of this group have the apices somewhat more marked and the wings more distinctly trigonate.

Group *perpensa* is somewhat aberrant and is distinguished by a longitudinal black shade from the base to the t. p. line.

None of the preceding species have in the s. t. line a clearly defined W mark. All the following are so distinguished, the outward indentation of the s. t. line being marked on veins three and four.

Group *cariosa* contains those species in which the secondaries are of various shades of gray to smoky brown, while group *inordinata* contains those species in which the secondaries are yellow, with a black outer marginal band.

In synoptic form the groups may be distinguished by the following table:

No W-mark in the s. t. line.

S. t. space with a triangular dark shade at middle and another at hind angle, crossing s. t. line at those points; transverse lines incomplete or punctiform Group *VULTUOSA*.

S. t. space concolorous; s. t. line obsolete or indefinite, median lines distinct.

Group *FINITIMA*.

Transverse maculation all obsolete, reniform more or less distinctly white marked.

Group *SPUTATRIX*.

Transverse maculation all evident.

S. t. space not paler; terminal space concolorous or paler, never darker; s. t. line preceded by a series of sagittate black spots which are sometimes confluent Group *DEVASTATRIX*.

As before; s. t. line distinct, no preceding dark shade or spots Group *ALTICOLA*.

S. t. space paler than median or terminal space, the latter darkest; s. t. line sometimes preceded by darker shades, never by sagittate spots; primaries wider with more produced apices Group *ARCTICA*.

Evenly colored; a distinct black longitudinal shade from base to t. p. line.

Group *PERPENS*.

A distinct W-mark in s. t. line on veins three and four.

Secondaries white or dusky Group *CARIOSA*.

Secondaries yellow with black margin Group *INORDINATA*.

GENUS LUPERINA Bdv.

Luperina niveivenosa Grt.

1879, Grt., Bull. Geol. Surv., v, 206. *Agrotis*.

Dull fusco-luteous, all the veins white marked. A black basal dash; another along hind margin. Basal half line obsolete. T. a. line marked only in submedian interspace, where it interrupts a broad black shade, which extends through the lower portion of this space to t. p. line; surmounting this dark shade is a clearer luteous shade. Orbicular narrow, oblique, pale; black-ringed. Reniform upright, outwardly indented, variable in size, black-ringed, with an interior pale annulus and concolorous center. A darker shade through the cell between the spots, and beyond the reniform the space is blackish to the t. p. line. This line is marked by a paler yellow shade, which is inwardly sharply defined, and outwardly merges into the ground color. S. t. line pale yellow, lunulate, interrupted forming an indefinite W, preceded by black, more or less sagittate spots, followed by smaller, less definite spots. Fringes usually paler at base. Secondaries pale fuscous, with paler fringes. Beneath, even pale fuscous, with a pearly luster. Head and thorax concolorous with the pale ground-color of primaries.

Expands 36 millimetres=1.45 inches.

HABITAT: Montana, Colorado.

No ♂ has been seen; four ♀♀—one of them, the type, has been under examination. The strongly white marked veins of primaries and the narrow oblique orbicular are distinctive. Mr. Grote evidently referred this species to *Agrotis* solely upon superficial appearance.

Luperina stipata Morr.1875. Morr. Pr. Ac. N. Sc. Phil. 1875, 64, *Hadena*.

Pale fuscous with usually a violet gray shading along the costal region. A black basal streak; a heavier streak on internal margin at base of t. a. line; and a broad black shade through submedian space between the ordinary lines. Median vein and its branches at end of cell, white to t. p. line. Sometimes veins 1 and 2 are powdered with white scales to the same point. Basal line obsolete; t. a. line marked only by a geminate oblique dusky shade in submedian space; t. p. line hardly marked superiorly, but distinct from vein four as a narrow pale line sharply limiting the dark shade in median space. S. t. line indefinite, marked by oblique dusky shades in terminal space and interrupted by paler streaks on veins three and four, reaching the outer margin. A series of black terminal lunules. Claviform very small, variable in size and shape. Orbicular concolorous, variably sized and formed, narrowly black ringed. Reniform indefinite, small, upright, constricted, resting on the white forks of the median vein. Secondaries pale ochery. Head and thorax concolorous with primaries, abdomen with secondaries. Beneath, very pale ochery in the ♀ darker. As a rule the ♀ is darker throughout than the ♂. The thorax is somewhat depressed, the anterior divided crest low and inconspicuous.

Expands 37 millimetres, 1.5 inches.

HABITAT.—Illinois, Massachusetts, Maine, Minnesota.

A very well marked species, recognizable by the white forks of median vein and the black transverse shade in median space.

Luperina passer Gn.1852. Gn., Sp. Gen., Lep. Noct. I, 195, *Mamestra*.1856. Walk., C. B. Mus. Lep. Het. IX, 231, *Mamestra*.1879. Grt. Can. Ent., XI, 179, *Hadena*.1882. Grt. New List, 27, *Luceria*.*loculata* Morr.1874. Morr, Bull. Buff. Soc. N. Sci. II, 110, *Luceria*.

1879. Grt., Can. Ent. XI, 179, pr. syn.

var conspicua Morr.1874. Morr. Bull. Buff. Soc. N. Sci. II, 110, *Luceria*.

Pale leather brown, varying to smoky or gray brown, all the lines indistinct, geminate. T. a. line usually obsolete; outwardly angulated in the interspaces. T. p. line more evident, even or slightly crenulate, its course sinuate. S. t. line faint, marked usually by the slight difference in shade between terminal and s. t. spaces, and sometimes by more or less distinct black preceding spots. Claviform very distinct, heavily outlined in deep black. Ordinary spots concolorous; orbicular round, black ringed; reniform large, kidney shaped, more or less completely black-ringed, outwardly somewhat paler. The median space is usually somewhat darker, and there is a more or less evident dusky shade running parallel and rather close to t. p. line. Secondaries fuscous. Be-

neath fuscous, hardly powdery, with an indefinite common darker shade and discal spot. Head and thorax concolorous.

Expands 34 to 45 millimetres, 1.35 to 1.80 inches.

HABITAT.—Massachusetts, Connecticut, New York, Illinois, Colorado, Oregon.

Widely distributed and easily recognizable by the prominent black ringed claviform, the usually even, pale leather-brown color, and broad primaries with rather obtuse apex and rounded outer margin. The body is plump. The differences between the type and varietal forms have been already pointed out.

Luperina burgessi Morr.

1874. Morr., Buff. Bull. 2, 109, *Luceria*.

1875. Grt., Check List, Noct., *Hadena*.

1880. Grt., Bull. Bkln. Ent. Soc. III, 36, *Hadena*.

1882. Grt., New List, 27, *Luceria*.

discors Grt.

1881. Grt., Trans. Kans. Ac. Sci. VII, 65, *Hadena*.

Purplish, smoky brown, basal and s. t. spaces usually paler, often with a distinct carneous tint. Basal line well marked, geminate, black. T. a. line geminate, inner line faint, outer line distinct, black, outwardly bent and angulated between the veins, more prominently below submedian vein. T. p. line geminate, outer line faint, inner line distinct, dentate on veins, outwardly bent over cell, thence parallel to outer margin. S. t. line fine, narrow, interrupted, marked by yellowish scales forming a more or less evident **W**-mark, preceded by black sagittate marks and followed by black interspaceal lines reaching to the wavy outer margin. A narrow pale line at base of fringes. A fine black longitudinal line at base and another on inner margin near that point. Claviform rather small, black ringed, a black line from its apex to t. p. line. Orbicular large, oblique, black ringed, concolorous or with a carneous tinge. Reniform large, kidney shaped, outwardly pale, rather indefinite, inwardly black margined. Secondaries white, with a very narrow dusky margin, widest in the ? . Beneath, primaries powdery, darkest toward apex; an interrupted outer line. Secondaries white, gray powdered toward costa where there is also a trace of the extra median line. Head and thorax concolorous, collar with a variably distinct black line.

Expands 39 to 41 millimetres, 1.60 to 1.65 inches.

HABITAT—Massachusetts (*Morr.*) Arizona, Nebraska.

We have seen no eastern specimens; those from the west agree perfectly with the description.

Luperina longula Grt.

1879. Grt., Bull. Geol. Surv., v, 204. *Hadena*.

Dark ash gray to smoky fuscous, with the maculation indistinct; transverse lines single. T. a. line irregularly dentate and angulate at

inner margin marked by the usual black dash. T. p. line outwardly bent over cell, with outward spurs on the veins making it crenulate. S. t. line pale, very indistinct, interrupted, the usual **W**-mark sometimes barely traceable, preceded by two black sagittate marks in the third and fourth interspace. A row of black terminal lunules. A black basal streak. Claviform variable in size and shape, usually incompletely outlined, suffused by a black shade that extends to the t. p. line. Ordinary spots large, faintly outlined; orbicular decumbent, elongate, oblique. Reniform upright, somewhat indented outwardly. Secondaries pale, smoky fuscous, lighter toward base. Beneath pale, powdery, with common outer line and discal dot. Head and thorax concolorous; collar somewhat paler inferiorly, patagiæ with a blackish shade near the dorsal margin. Abdomen with basal tuft only.

Expands 42 to 44 millimetres, 1.70 to 1.80 inches.

HABITAT.—Colorado, Nevada, Washington, and Kansas.

Closely allied to *burgessi* in habitus and pattern of ornamentation, but larger, broader-winged, more evenly gray, and with dusky secondaries.

In this, as in the preceding, the thoracic and basal tufts of abdomen are distinguishable and even well marked, yet they are loose, and the insects as a whole differ in habitus from their nearest allies among the *Hadena* proper.

Genus **XYLOPHASIA** Steph.

Group *vultuosa*.

The most obvious and distinctive character of this group is found in the peculiar maculation of the terminal and s. t. spaces. There are in the former two somewhat triangular dusky shades, the one with the tip near apex of wing and its base just above the middle of outer margin, the point extending inwardly a short distance into the s. t. space. The apex of the second dusky shade is close to the base of the first, and its broadest point is just within the hind angle, where also it crosses the s. t. line; that portion of this shade in s. t. space being often most prominent. The transverse maculation is more or less obsolete and punctiform, except in *remissa*, and the species are closely allied. The terminal darker shades above described are constant and form an obvious distinction. *Remissa* is a peculiarly intermediate form. It strongly resembles in maculation that series of which *indirecta* or *mactata* are typical, and it also has the broad wings of that series. It resembles *finitima* in ground color, the basal streak, and the structure of the ♂ genitalia, the clasper only being shorter and more slender. From all the others of the present group it differs by the distinct black shade connecting the median lines and by the large contrasting pale ordinary spots. The typical maculation of the s. t. space determines the reference of the insect to this group.

The remaining species agree in narrower wings, more or less obsolete or indistinct maculation, and indistinct and indefinite ordinary

spots, of which the reniform is usually more or less filled with black. There is no connecting shade between the median lines.

Illata, or as it is more commonly known, *suffusca*, is of a pale violet gray, with a reddish suffusion, which becomes darker and more intense toward costa. The maculation is obsoletely indicated, and the species easily recognizable. The tip of harpe is of the usual form, the spinulation along inner margin sparse. The clasper is much reduced in size, is cylindric and rather acutely terminated, and arises from the margin of the harpe just back of tip.

Vultuosa is more yellowish or reddish luteous, with the maculation more distinct, and with a black basal streak which separates it at once from the preceding. The harpe and tip of ♂ are as in *suffusca*, but the clasper does not arise from the margin, is stronger and somewhat curved.

Apamiformis is marked like *vultuosa*, but differs at once by the deeper, more chocolate-brown color. The genitalia are peculiar. The tip is much like that of the preceding species in shape, but the superior angle is very broadly rounded and excavated, and the greater part of the inner face of tip is rather densely clothed with coarse spinules. The clasper is very short, thick, straight, and obtuse, very different from the long slender form peculiar to most species of the genus.

In synoptic form the differences are as follows:

SYNOPSIS OF SPECIES.

Median lines connected by a black dash, ordinary spots large, distinct, contrasting	REMISSA
Median lines not so connected, ordinary spots not contrasting.	
No basal black streak.	
Violet or bluish-gray, with reddish suffusion, darker more distinct toward costa	ILLATA
A distinct black or brown basal streak.	
Reddish luteous, the costal region darker, reniform, narrow, constricted	VULTUOSA
More uniform, darker chocolate brown, reniform larger, outwardly white marked	APAMIFORMIS

Xylophasia remissa Hbn.

1812. Hbn., Noct., 423, *Noctua*.

1816. Hbn., Verzeichniss 219, *Astrapetis*.

1852. Gn. Sp. Gen., Noct. I, 208, an var. *Apamea gemina*.
indocilis Wlk.

1856. Wlk., C. B. Mus., Het. ix, 178, *Xylophasia*.

1882. Grt., Ill., Essay 44, pr. syn.

Luteous or livid gray, with a more or less evident deep red suffusion, median space darker above the black transverse shade. A black basal streak; another along hind margin to t. a. line. Basal line geminate, distinct. T. a. line outwardly arcuate, with short inward dents on veins, geminate, the inner line more or less obsolete, the included space

slightly paler. T. p. line outwardly bent over reniform and there more or less indistinct and punctiform, then nearly straight and better marked to hind margin. The outer portion of line is obsolete or marked only by venular points. S. t. line sinuate, marked only where the dark shades of terminal space above and below the middle cross it. A row of black terminal lunules. Claviform moderate, black ringed, a broad black shade extending from its inferior margin across the median space. Ordinary spots large, of pale ground color, contrasting with the darker setting, and more prominent by the blackish filling of the cell between them. Orbicular oval oblique. Reniform of normal form, the space from its outer margin to t. p. line of same pale color as the s. t. space beyond. Secondaries smoky fuscous, paler at base. Beneath, powdery with common line and discal spots; primaries with darker disc and broad pale outer margin. Head and thorax of ground color, patagiæ darker brown. Tuftings distinct.

Expands 35 to 40 millimetres, 1.40 to 1.60 inches.

HABITAT.—Middle and Eastern States, North Carolina.

The relationships of this species are elsewhere discussed.

Xylophasia illata Wlk.

1857. Wlk., C. B. Mus., Lep. Het. XI, 742, *Agrotis*.

1876. Grt., Can. Ent. VIII, 29, *Hadena*.

1877. Grt., Can. Ent. IX, 29, *Hadena*.

insignita || Wlk.

1857. Wlk., C. B. Mus., Lep. Het. x, 353, *Agrotis*.

1857. Wlk., C. B. Mus. Lep. Het. XI, 742, n. b. l.

suffusa Morr.

1875. Morr. Proc. Ac. N. Sci. Phil. 1875, 61, *Hadena*.

1877. Grt., Can. Ent. IX, 29 = *illata*.

Bluish gray with a more or less well marked reddish suffusion, always well marked along costal region. Median lines indistinct, punctiform or only faintly marked. Claviform obsolete, indicated only by a few ferruginous scales, or entirely wanting. Orbicular rather small, oval, oblique, with rusty outline, scarcely distinct. Reniform well sized, of ordinary form, black filled. S. t. line as is usual in the group, the preceding dark patch near hind angle unusually prominent: A row of black terminal lunules. Secondaries smoky, fuscous, paler toward base. Beneath dusky, powdery, with indistinct common discal line and spots. Head and thorax concolorous with primaries. Tuftings small but distinct.

Expands 37 to 41 millimetres = 1.50 to 1.65 inches.

HABITAT.—Canada to Texas to Colorado.

The species is obscurely marked, and yet very recognizable by the bluish gray ground with reddish suffusion prominent toward costa, the reniform black filled and rather prominent.

Xylophasia vultuosa Grt.1875. Grt., Pr. Ac. Nat. Sci. Phil., 1875, 420, *Hadena*.

Somewhat reddish-luteous, becoming darker, more brownish toward costal region. A brownish black basal streak and another along hind margin to t. a. line, broader and better marked. Basal line geminate, marked in costa only. T. a. line geminate, more or less indistinct, outwardly arcuate, with inward dents on veins, that on vein 1 long and well marked, included space often white shaded below vein 1. T. p. line brown, lunulate, interrupted, often obsolete, followed by a series of geminate black venular dots, which when alone present are readily mistaken for the t. p. line itself. S. t. line marked only as usual in the group. A row of terminal black lunules. Veins white marked in s. t. space. A well marked brown median shade darkening the cell between stigmata and scalloped or lunulate below that point. Claviform very small, poorly marked. Orbicular narrow, elongate, pale, with brown central dot; reniform narrow, upright, constricted, more or less indefinite; a dusky central line. Secondaries blackish, fringes paler; beneath dusky, powdery, with distinct outer line and discal spot. Head and collar inferiorly concolorous with primaries. Thorax darker, patagiæ dark brown, with paler margin; dorsal tuft distinct and also paler.

Expands 37 to 41 milimetres, 1.50 to 1.65 inches.

HABITAT—Canada, New York, New Jersey, Wisconsin, Pennsylvania.

The ♀♀ are usually well marked and somewhat larger than the ♂♂ in which the color is usually paler, and the maculation through median space is often if not usually obsolete. The above description applies to well-marked ♀♀.

Xylophasia apamiformis Gn.1852. Gn., Sp. Gen. Noct. I., 137, *Xylophasia*.1856. Wlk., C. B. Mus. ix., 176, *Xylophasia*.1873. Grt., Buff. Bull. I., 109, *Hadena*.*contenta* Wlk.1856. Wlk., C. B. Mus. Lep. Het. ix., 233, *Mamestra*.

1868. Grt. and Rob., Trans. Ain. Ent. Soc. II., 78, pr. syn.

Rather pale chocolate brown, usually even, more rarely powdered. The maculation is precisely as in *vultuosa*, except that the basal streak is less marked; the claviform, though small, is distinct, and the reniform is larger, black filled, and outwardly white marked. Secondaries smoky or blackish, paler at base, and with yellowish fringes. Beneath, powdery, with outer line and discal lunule; primaries with disc darker; costal and broad terminal space paler. Head and thorax concolorous, the tuftings distinct.

Expands 40 to 47 millimetres, 1.60 to 1.90 inches.

HABITAT—New York, New Jersey, Pennsylvania, and Illinois.

Closely allied to *vultuosa*, but obviously distinct by the much darker ground color and the differently shaped reniform.

The reference of *contenta* Wlk. to this species can not be accepted as final, since Mr. Grote has more recently referred it to *devastatrix* as a synonym of that species.

Group *finitima*.

The distinguishing feature of this group is found in the obsolescence of the s. t. line, the distinctly defined usually darker median space, and single or obsoletely geminate median lines. The ordinary spots are distinct in all the species, though not always well defined. The terminal space is either concolorous or only slightly darker, and the s. t. space contains no prominent spots or shades, the darkening toward costa excepted.

Two of the species are very rare; one thus far known only in the ♀ sex, and only one specimen at that; the other known in both sexes, but only single specimens of each.

Exornata is a rusty or somewhat paler red-brown species, with dark powderings, distinct single median lines and somewhat indefinite ordinary spots. The ♂ genitalia are of the usual type, the clasper stout, and reaching to the end of tip. The ♂ type is from Labrador; the only ♀ seen, from Colorado.

Hulstii is a very strongly marked species. The color is rather pale, clear luteous, the superior part of median space dark red brown, the large reniform paler and contrasting. The ♀ only is known.

Finitima, which I believe is only a local variety of the European *basilinea*, differs from both the preceding by the distinct black basal streak, and the black-ringed ordinary spots. The median space is reddish brown, the remainder of wing a somewhat livid or violet gray. The genitalia of the ♂ are like those of *exornata*, but the clasper is still thicker, and there is a dense clothing of small spinules along inner margin to the superior angle. Speyer has pointed out the only observable differences between the European and American forms of this species, which simply amount to a somewhat clearer, more definitely cut, ornamentation of the American race. The tuftings in this species are well marked, as they are also in *exornata*. The ♀ *Hulstii* is somewhat imperfect, but in this species also they will probably be found moderately prominent.

In synoptic form the differences appear thus:

No basal black streak.

Color of median space even. Rusty or red brown with darker powderings.. EXORNATA

Median space much darker superiorly, the reniform pale and contrasting

ground color pale clear luteous.....HULSTII

A distinct black basal streak, ground color livid, somewhat violet gray,

median space darker, the maculation distinct.....FINITIMA

Proc. N. M. 90—27

Xylophasia exornata Moeschl.

1864. Moeschl, Wien. Ent. Monatschr. iv, 364, pl. 9, f. 5, *Hadena*.

1867. Pack., Proc. Bost. Soc. N. H. xi, 39, *Hadena*.

Rusty reddish brown, median space rather strongly, rest of wing sparsely black powdered. Median lines distinct, single. T. a. line upright, with an outward curve in submedian interspace. T. p. line with outward points on veins; outwardly bent over cell, incurved below. Basal line indistinct. S. t. line obsolete, traceable by a difference in shade between s. t. and terminal spaces, but not otherwise. The s. t. space is lighter than other portions of wing, except toward costa, where it is more heavily black powdered. Claviform very small or entirely wanting. Ordinary spots rather large, paler, indefinite. Secondaries blackish or smoky fuscous, fringes paler. Beneath smoky, powdery, with indefinite outer line; secondaries with discal lunule. Head and thorax concolorous with primaries, the tuftings not prominent.

Expands 33 to 40 millimetres, 1.32 to 1.60 inches.

HABITAT—Labrador, Colorado.

The kindness of Mr. Moeschler has enabled me to examine the ♂ type. A ♀ specimen from Mr. Graef's collection is from Colorado. It is somewhat more sordid in appearance than the Labrador ♂ and is smaller, but unquestionably is the same species. The distribution is interesting, and intervening points ought to yield the same species. The ♀ from Colorado has an *anartiform* appearance not noted in the ♂, and caused by the imperfect condition of the example. The vestiture is largely hairy.

Xylophasia hultii Grt.

1880. Grt. N. Am. Ent. i. 93, *Hadena*.

Ground color a somewhat clear bright luteous with sparse carmine powderings; superior portion of median space dark brown, inferior portion contrasting, whitish. Basal space, dark powdered in costa; s. t. space with a broad, rather carmine shaded, dark costal patch. Basal line geminate, red brown, distinct. T. a. outwardly oblique, curved between veins, brown; geminate at middle, the inner line formed of red brown scales. T. p. line simple, nearly parallel with outer margin, with outward dents on veins. S. t. line marked at inception by the dark patch in s. t. space and the pale apex, barely traceable through the rest of its course by a sparse powdering of deep red-brown scales, and the darker powdering in terminal space. A row of black terminal lunules. Claviform moderately long, narrow, rusty. Orbicular moderate, ovate, oblique, rusty ringed, with a sparse powdering of white scales. Reniform large, kidney shaped, contrasting whitish, except where invaded by the ferruginous transverse shade which fills the cell between the spots and forms an angle below reniform, running thence close to and parallel with t. p. line. Secondaries ochrey fuscous, powdery; a faint discal lunule.

Beneath, primaries with blackish disc and broad, pale terminal space; secondaries pale ochreous, with brown powderings, outer shade line and discal spot.

Expands 40 millimetres = 1.60 inches.

HABITAT.—Colorado.

The unique ♀ type from Mr. Hulst's collection was before me. The species is so well marked that there is no possibility of mistaking it.*

Xylophasia finitima Gn.

1852. Gn., Sp. Gen. Noct. I, 206, *Apamea*.

1856. Wlk., C. B. Mus., Lep. Het. IX, 250, *Apamea*.

1875. Speyer, Stet. Ent. Zeit. 1875, 150, an var. *basilinea*.

1878. Graef, Bull. Bkln. Ent. Soc. I, 9, an var. *basilinea*.

1882. Grt., New List 1882, *Hadena*.

Pale, livid, or somewhat violet gray, the median space more red brown, a slight crimson suffusion in costal region of basal space, and a larger, darker shade fills the costal region of the s. t. space. Terminal space somewhat darker gray; a distinct black basal streak. Basal half line geminate, faint. T. a. line geminate, inner line more or less obsolete, outer line blackish, darker toward inner margin; its course outwardly arcuate. T. p. line geminate, black, outer line punctiform or obsolete; somewhat outwardly bent over cell, and with a small inward line to hind margin. S. t. line faintly marked by a slight difference in shade between s. t. and terminal spaces: a row of black terminal lunules. Claviform small, black ringed. Ordinary spots large, black ringed; orbicular oblique, often with a narrow white interior annulus; reniform, with broader distinct white annulus, inferiorly with black powdery filling. Secondaries smoky fuscous, paler toward base; a row of black terminal lunules. Beneath powdery, disc of primaries dusky, outer margin broadly pale; secondaries paler, with median transverse darker line; both wings with darker discal spots. Head and thorax concolorous with primaries, the tuftings distinct; dorsal tuftings of abdomen distinct.

Expands 36 to 39 millimeters = 1.44 to 1.76 inches.

HABITAT.—Middle and Eastern States, Canada, Colorado.

The European examples differ from the American variety by less definite maculation and more even and less contrasting color. Still I think there is no question as to their specific identity, though the name *finitima* may be retained as applying to our American race.

Group *sputatrix*.

In this group all the maculation becomes indistinct or obsolete, the ground color is even, and there is no contrast except in the reniform, which is more or less white or pale powdered. In structure the species do not differ from the *devastatrix* group.

* Mr. Bruce sent me in February, 1891, a single specimen in a lot for determination. The maculation is like the type but the colors are more sordid throughout.

Lateritia, or, as it is generally named, *dubitans*, is reddish brown, and recalls somewhat some species of the *cariosa* group (*genialis*); but differs evidently. The primaries are proportionately somewhat longer and less obtuse than in the other members of the group. The harpes and tip of ♂ are of the usual form, the interior edge somewhat sparsely spinulated. The clasper is distinct, rather stout, and reaches rather more than half way to the end of tip.

Cogitata closely resembles *lateritia* and is generally confused with it. It differs at sight in the more obtuse primaries and more discolored reniform, but otherwise the markings are very like its ally. The genitalia are quite distinctive; the clasper is much longer than in *lateritia*, and there is a supplemental process at the base of the long hook.

Sputatrix differs evidently from *lateritia* not only in color, but in the more obtuse primaries. The ground color is dark blackish brown, the median lines obsolete, and only the strongly pale marked reniform prominent. The tip of harpes is much as in *lateritia*; but the clasper is much longer and rather more slender. There is also an additional small, slender, curved, chitinous hook at about the middle of the harpe.

Plutonia is smaller than either of the preceding, as dark as *sputatrix*, but with the reniform only narrowly pale marked outwardly, and a distinct black streak along internal margin near base. The tip of ♂ harpes is distinctive and rather peculiar. The outer margin is somewhat rounded, the superior margin broadly lobed, and furnished with a brush of hair; the inner margin has a narrow series of spinules nearly to the junction with main shank of the harpe, and here there is a tuft of divergent spinules. The clasper is short and straight, arising from inferior margin of side piece close to tip.

The differences are sufficiently noted without again giving them in synoptic form.

Xylophasia lateritia Hufn.

- 1767. Hfn., Berl. Mag. III, 306, *Noctua*.
- 1816. Hub., Verzeichniss 243, *Septis*.
- 1852. Gn., Sp. Gen. Noct. I, 137, *Xylophasia*.
- 1857. Wlk., C. B. Mus. Lep. Het. x, 170, *Xylophasia*.
- 1874. Grt., Can. Ent. VI, 215, *Hadena*.
molochina Hbn.
- 1812. Hbn., Samml. Noct. 74, *Noctua*.
- 1816. Hbn., Verzeichniss 243, pr. syn.
insignita Wlk.
- 1857. Wlk., C. B. Mus. Lep. Het. XI, 729, *Apamea*.
- 1868. Grt. and Rob., Trans. Am. Ent. Soc. II, 78, pr. syn.
- 1873. Grt., Buff. Bull. I, 108, pr. syn.
dubitans Wlk.
- 1857. Wlk., C. B. Mus. Lep. Het. IX, 232 *Mamestra*.
- 1873. Grt., Buff. Bull. I, 108, *Hadena*.
- 1874. Speyer, Stell. Ent. Zeit. 446, an var *lateritia*.
- 1874. Grt., Can. Ent. VI, 215 = *lateritia*.

Yellowish red, or leather brown, with sparse white powderings, more obvious in orbicular, and distinct in reniform, which is outwardly white.

marked. Lines obsolete or faintly marked. T. a. line strongly dentate between veins. T. p. line crenulate, parallel with outer margin. S. t. line very indefinite, irregularly sinuate and dentate, often punctiform, rarely with darker preceding shade. Orbicular oval, indefinite; reniform large white powdered, outwardly with a broad lunate white defining mark. Secondaries pale smoky fuscous, darker outwardly, fringes reddish. Beneath reddish or fuscous, more or less powdery, with a variably distinct outer line and discal spot. Head and thorax concolorous with primaries; tuftings small but obvious, not very distinctly marked.

Expands 37 to 50 millimetres; 1.5 to 2 inches.

HABITAT.—United States and Europe.

Widely distributed and fairly common everywhere. The European specimens are as a rule paler and more evidently white powdered, but there are specimens from our fauna agreeing perfectly with those from Europe. There is no difficulty in identifying the species.

Xylophasia cogitata Smith, sp. nov.

Head, thorax and primaries brick red, the former immaculate. Primaries with all the transverse maculation faint, yet all traceable. Basal line vague, narrow, pale. T. a. line pale, upright, but slightly angulate, scarcely defined. T. p. line faint, pale, evenly outcurved. S. t. line white, well marked at inception, but becoming lost beyond the middle, its course but slightly and irregularly sinuate. A vague but traceable darker red median shade. Claviform small, indefinitely outlined in darker red. Orbicular small, oval, oblique white ringed. Reniform large blotchy white, not completely defined. Secondaries fuscous, with a reddish suffusion, a lunulate marginal line, fringes more carneous; a faint discal line and lunule. Beneath paler, powdery, with an outer line and discal dots on all wings.

Expanse 1.60 to 1.64 inches; 40 to 41 millimetres.

HABITAT.—Sierra Nevada California, Colorado.

This species has probably been confused in collections with *lateritia*, which it closely resembles in habitus, but from which it differs very obviously in wing form, the primaries being much shorter and more obtuse. The orbicular is more distinct, the reniform more blotchy; but otherwise the maculation seems identical. The genital structure, however, is very distinctive and well emphasizes the character given by the wing form.

It is not impossible that the distribution is considerably wider than above given, and, in the light of later experiences it may not be improbable that our eastern form is not the same as the European species. This I can not determine now, from lack of material.

Xylophasia morna Strk.

1879. Strk., Rept. Chief Eng., 1878-'79, v, p. 1861, *Hadena*.

"♂ Expands $1\frac{3}{4}$ inches. Head and thorax cinnamon colored. Abdomen of same color, but paler.

"Upper surface of primaries same color as head and thorax; darkest from discal spot inward; markings all more or less indistinct. T. a. line deeper reddish and double. T. p. line apparently single. Reniform indistinct, its lower part on the median nervule filled with a gray or lead-colored spot, which is the only mark of any prominence. Exterior margin of wing bordered with a dark shade; fringe same color as the last. Secondaries reddish white, with broad smoky border exteriorly; fringe pale.

"Under surface primaries shining cinnamon color, paler than above but devoid of dark border.

"One male at Rio Blanco, near its headwaters."

I have seen nothing that agrees with the above description, but it would seem to be related to *lateritia*, or more particularly *cogitata*, from which, however, it differs obviously.

Xylophasia sputatrix Grt.

1873. Grt., Buff. Bull. I, 190, *Hadena sputator*.

insignita Wlk.

1857. Wlk., C. B. Mus. Lep. Het. XI, 729, *Apamea*.

1873. Grt., Buff. Bull. I, 190, n. b. l.

Blackish deep brown, rarely with a more reddish brown shade through center of wing. Median lines obsolete. S. t. line punctiform, the spots consisting of scattered yellowish scales, a more or less obvious black preceding shade. Claviform small; traceable. Orbicular moderate; oval, often obsolete, sometimes white powdered. Reniform pale powdered, its outer portion pale, blotchy, forming a distinct contrast to the dead black brown of the rest of the wing. Secondaries smoky fuscous, with pale yellowish or pinkish fringes. Beneath with reddish and black powderings. Primaries with paler terminal space; secondaries with distinct line and discal spot. Head and thorax concolorous with primaries; tuftings small. Abdominal tuftings distinct.

Expands 40 to 43 millimetres, 1.60 to 1.70 inches.

HABITAT.—Eastern, Middle, and Northern States; Canada.

Readily distinguished by the dull blackish brown color, the maculation obsolete, and the reniform contrastingly pale marked. It is not uncommon.

Xylophasia plutonia Grt.

1883. Grt., Can. Ent. xv, 9, *Hadena*.

Blackish brown, a paler shade at base, and less distinct beyond reniform to t. p. line. A distinct deep black streak along inner margin near base. Median lines obsolete. S. t. line a series of elongate black

spots. A row of terminal darker lunules. Orbicular indistinct, but traceable, elongate, oblique. Reniform large, upright, somewhat constricted at middle, with a few white scales along outer margin. Secondaries smoky; fringes paler, more yellowish. Beneath blackish, powdery; secondaries with distinct outer line and discal spot. Head and thorax concolorous with primaries; tuftings distinct; yellowish.

Expands 37 millimetres; 1.5 inches.

HABITAT.—Maine, Minnesota.

The unique type is from Mr. Thaxter. The species is nearest to *sputatrix*, but is smaller, lacks the contrasting pale markings of reniform, and has a black streak along inner margin near base.

[Since the above has been in the hands of the printer, Dr. O. Lugger has sent me a specimen for determination, taken at St. Anthony Park, Minn. It agrees perfectly with the Maine specimen.]

Group *alticola*.

This group is established for a single species, rather aberrant in habitus, but most nearly related to the *devastatrix* series, differing by the lack of the spots preceding the s. t. line. The latter is even and distinct. The claviform is wanting, there is no connecting dash, no basal dash, and there are no contrasts in color throughout the wing. Altogether the species is recognizable and easily distinguished.

Xylophasia alticola Smith, sp. nov.

Head and thorax ashen gray, with more blackish admixed scales. Primaries paler, powdery, with an admixture of yellowish green, all the maculation distinct. Basal line white, not definite. T. a. line black, with a preceding white line, outwardly oblique to submedian interspace, then with a broad inward tooth on internal vein. T. p. line nearly parallel with outer margin, regularly dentate, black followed by a white line. S. t. line white, sinuate, and small W mark at middle. An interrupted blackish terminal line; fringes cut with white. A vague, dusky, median shade. Orbicular rounded, not defined, small, white. Reniform upright, moderate in size, white ringed, center concolorous. Secondaries evenly fuscous, fringes white. Beneath pale, powdery, with a common outer line and a discal spot on all wings.

Expands 1.45 inches, 36 millimetres.

HABITAT.—Gibson Mountains, Colorado, 12,500 feet.

A single male specimen collected by Mr. Bruce is before me. The species differs prominently from all the described species, and has no close allies in the genus. There is a vague suggestion of *devastatrix* in the habitus, and perhaps to this species it may be most nearly related. The greenish shade is not localized, but is rather more prominent in the basal and s. t. spaces.

Group *devastatrix*.

This group differs from the preceding (*sputatrix*), by the less prominent tuftings, more even outer margin of primaries, the inner angle not retracted, and most obviously by the fact that the terminal space is never darker, but rather paler than the s. t. space, and except in *sommeri* the s. t. space is not paler than the median space. The s. t. line in all the species is preceded by a series of sagittate dashes, which are sometimes confluent, but always present. The genitalia of two of the species are unknown, but as the others, their near relatives, agree very well in this point with the other typical groups, they will probably not present anything very peculiar.

Ducta, of which *separans* is a synonym, is nearest to the *arctica* group by the tuftings, which, though perhaps less prominent, are like those of that group. Is a dusky, blackish species and is easily recognized by the small but distinct **W** mark of the s. t. line. The ♂ has not been examined.

Impulsa is a somewhat purplish black species, with deep, velvety black markings and yellow punctiform s. t. line. There is no difficulty in its recognition. The outer margin of tip of ♂ harpes is somewhat rounded, and as usual, with a fringe of spinules. At the inferior angle there is a brush of longer spines extending half way to the superior angle, which is rather broad, and as usual, excavated. The clasper reaches to the end of tip and is slender, somewhat twisted. Inside of this is a shorter, slender, chitinous process somewhat enlarged toward tip.

Devastatrix, the type of the group, has the tuftings much reduced in size, and there is a strong suggestion of the *Luperina* group in its general habitus. It varies from pale to blackish gray; the median lines are rather even, geminate, the included space pale in dark specimens. S. t. line also rather even, and the sagittate preceding dashes are more or less confluent. The genitalia are essentially like those of *impulsa*, except that the superior angle is somewhat narrowly prolonged. The clasper is not so long and perceptibly stouter. Altogether, though variable, the species is well marked and easily recognizable.

Exulis is a northern form and exceedingly variable. It is luteous or rust brown, with blackish or darker powderings, and the veins and ordinary spots, usually white marked. Often the white powderings extend to other parts of the wing, and often the transverse lines are accompanied by white shades. From all others in this group it is easily distinguished by the ground color. The tip of ♂ harpe differs from the others in the group by having the brush of spines at inferior angle extending along the inferior margin to the superior angle, which is broadly rounded and, as usual, excavated.

Sommeri is also a northern species, differing from all others in the group by the darker median space, though agreeing in other features. In the two last named species the tuftings are distinct; more so than in *devastatrix*; less so than in *ducta* and *impulsa*. No ♂ of this has been examined.

SYNOPSIS OF SPECIES.

A distinct **W** mark in s. t. line; blackish gray, tuftings very prominent.....DUCTA
No **W** mark in s. t. line.

Purplish black; markings velvety black.....IMPULSA

Ash gray or darker; t. p. line even, or but little dentate.....DEVASTATRIX

T. p. line distinctly dentate and crenate.

Luteous or rusty brown, with black and white powderings, the latter most prominent on the veins.....EXULIS

Median space luteous brown, otherwise gray or paler.....SOMMERI

Xylophasia ducta Grt.

1878. Grt., Bull. U. S. Geol. Surv. iv 176, *Hadena*.
separans Grt.

1880. Grt., Bull. U. S. Geol. Surv. vi 260, *Hadena*.

Blackish, or smoky fuscous, the lines black. Basal line geminate, rather indistinct, resting on a small longitudinal black mark; a similar small black dash at internal margin, often obsolete. T. a. line outwardly curved between veins; inner portion of the line obsolete. T. p. line dentate or crenulate on veins, outwardly curved over cell, and with an inward curve below that point. S. t. line whitish, often interrupted, and more or less punctiform; forming a distinct, though small, **W** on veins 3 and 4; preceded by black sagittate dashes in interspaces, and followed by more or less distinct similar marks connecting with a series of small terminal dots. Claviform concolorous, black-ringed, variable in size, and often connected with t. p. line by a blackish shade. Ordinary spots large, narrowly black ringed, slightly paler; reniform, with a series of white scales near outer margin. Secondaries blackish gray, paler at base; a dusky discal spot. Beneath blackish, powdery, with outer line and discal spot. Head and thorax concolorous, with primaries; palpi white marked.

Expands 40 to 42 millimetres, 1.60 to 1.68 inches.

HABITAT: New York, Wisconsin, Maine, Washington.

Rather widely distributed, but not common. No ♂ has been obtainable for dissection, though we have seen that sex. Mr. Grote's *separans* was based on a pale specimen, with a more than usual resemblance to *devastatrix*.

Xylophasia impulsa Gn. .

1852. Gn., Sp. Gen. Noct. i, 194, *Mamestra*.

1856. Wlk., C. B. Mus. Lep. Het., ix, 231, *Mamestra*.

1873. Grt., Buff. Bull. i, 108, *Hadena*.

v. mixta Grt.

1880. Grt., Bull. U. S. Geol. Surv. vi, 264.

Black, with a purplish tinge, the markings intense, velvety black, the lines geminate. Basal line distinct, joining a short basal streak. T. a. line outwardly oblique or arcuate, curved between veins, inner line less distinct except at hind margin, where it joins a deep black streak toward base. T. p. line bisinuate, the inner line lunulate, the outer less

distinct and very even. T. p. line, consisting of a series of yellow points preceded by black sagittate marks. Claviform small, black ringed. Orbicular moderate, oval oblique. Reniform large, kidney-shaped, outwardly with some pale powderings. A distinct median shade oblique from costa between the ordinary spots nearly to t. p. line; then close to and parallel with that line to hind margin. Secondaries smoky black, paler toward base. Beneath purplish black, powdery, with distinct outer line and discal spots. Head and thorax concolorous with primaries; tuftings prominent.

Expands 35 to 42 millimetres=1.40 to 1.70 inches.

HABITAT.—Eastern and Middle States, Texas.

Of the variety *mixta* Mr. Grote says: "the pale powderings are more noticeable, the claviform rounded, all the lines narrower and more distinct, the reniform powdered with whitish." It is from Texas, and has not been seen by me.

Xylophasia devastatrix Brace.

1819. Brace, Am. Journ. Sci. i, 154, *Phalæna*.

1862. Harris, Inj. Ins., Flint ed., 445, *Agrotis*.

1869. Riley, 1st Rept. Ins. Mo., 83, *Agrotis*.

1873. Grt., Buff. Bull. i, 108, *Hadena*.

1875. Speyer, Stett. Ent. Zeit. 36, 147, *Hadena*.

1878. Grt., Bull. U. S. Geol. Surv. iv., 178, *Hadena*.

1881. Riley, Suppl. and Gen. Index to Mo. Repts., 56, *Hadena*.

1883. Saunders, Fruit Ins. 329, pp. 341, 342, *Hadena*.

ordinaria Wlk.

1856. Wlk., C. B. Mus. Lep. Het. ix, 232, *Mamestra*.

1868. Grt. & Rob., Trans. Am. Ent. Soc. ii, 77 pr. syn.

1877. Grt., Can. Ent. ix, 128 pr. syn.

1882. Grt., Ill. Essay, 43 pr. syn.

contenta Wlk.

1856. Wlk., C. B. Mus. Lep. Het. ix, 233, *Mamestra*.

1882. Grt., Ill. Essay, 43 pr. syn.

abjecta var. † Gn

1852. Gn. Sp. Gen. Noct. i, 194, *Mamestra*.

1875. Speyer, Stett. Ent. Zeit. 36, 147, *Hadena*.

Luteous to ash, to blackish gray, markings black or blackish. A small basal streak, and another at hind margin near base. Basal half line usually distinct, geminate. T. a. line outwardly oblique, sometimes arcuate, curved between veins; distinctly geminate. T. p. line geminate, the included space paler; outwardly curved over all cell, thence inwardly oblique to margin, its course rather even; only slightly dentate on veins. S. t. line pale, sometimes more or less punctiform; tolerably even except at apex, where it bends abruptly inward; preceded by a series of dark or black sagittate spots, which are sometimes more or less confluent. A row of dark or black terminal lunules. A distinct median shade between ordinary spots, and then near to and parallel with t. p. line, sometimes connected with it by a dark shade opposite claviform. Claviform small, black ringed, sometimes with a dusky shade. Orbicular variable in size and form, dark ringed, sometimes

with a yellowish suffusion. Reniform large, upright, centrally constricted, black ringed, annulate, with white or yellow scales. Secondaries fuscous or smoky, darkest outwardly; a distinct discal lunule. Beneath variable in shade, powdery, with variably distinct outer lines and discal spots.

Expands, 35 to 46 millimetres=1.40 to 1.75 inches.

HABITAT.—United States and Canada.

A common and widely distributed form, varying greatly in every respect, and yet retaining a peculiar habitus that to the student betrays the species at a glance. The eastern specimens are, as a rule, more sordid and more evenly gray, while specimens from the Pacific slope show more contrast in color and the maculation is more sharply defined. Occasionally a specimen is found that is blackish throughout and leaves the lines visible by their pairer included spaces; and one specimen before me is blackish, except for the median space. The tuftings are not prominent, and the species shows a decided relationship to the *Luperina* group of the genus.

The bibliography is far from complete, all the economic references being omitted. The species is, in the larva state, one of the most common and destructive cut worms, and the life history has been written frequently.

Xylophasia exulis Lef.

1836. Lef., Ann. Soc. Ent. Fr. v, 391, pl. 10, p. 1, *Hadena*.
1852. Gn., Sp. Gen. Noct. I, 185, *Crymodes*.
1856. Wlk., C. B. Mus. Lep. Het. IX, 220, *Crymodes*.
gelata Lef.
1836. Lef., Ann. Soc. Ent. Fr. v, 393, pl. 10, p. 30, *Hadena*.
1852. Gn., Sp. Gen. Noct. I, 185, *Crymodes*.
1856. Wlk., C. B. Mus. Lep. Het. IX, 220 *Crymodes*.
grænländica Zett.
1839. Zett. Ins. Lap. 939, *Hadena*.
1845. H. Sch., Schmett. Eur. II, 274, 284, pl. 31, p. 151, *Polia*.
1852. Gn., Sp. Gn. Noct. I, 185, *Crymodes*.
1856. Wlk., C. B. Mus. Lep. Het. IX, 219, *Crymodes*.
cervina Germ.
1844. Germ., Fn. Ins. Eur. 22, No. 19.
marmorata Zett.
1839. Zett. Ins. Lap., 937, *Hadena*.
1845. H. S., Schmett. Eur. II, pl. 451, *Polia*.
1856. Wlk., C. B. Mus. Lep. Het. IX, 220=*poli*.
diffusa Geyer.
1837. Geyer, Zutr. Hüb. Saml. Ex. 9, ff. 821, 822, *Exarnis*.
1871. Staud. Cat. Lep., 100=*exulis*.
1881. Grt., Can. Ent. XIII, 91=*exulis*.
gelida Gn.
1852. Gn., Sp. Gn. Noct. I, 186, pl. IV, p. 7, *Crymodes*.
1856. Wlk., C. B. Mus. Lep. Het. IX, 221, *Crymodes*.
poli Gn.
1852. Gn., Sp. Gen. Noct. I, 187, *Crymodes*.
1856. Wlk., C. B. Mus. Lep. Het. IX, 220, *Crymodes*.
borea Gn.
1852. Gn., Sp. Gen. Noct. I, 186, *Crymodes*.

Reddish or luteo-fuscous, more or less black powdered, veins often and sometimes wing generally, with white powderings. A small black basal streak and a more prominent shade along internal margin at termination of t. a. line. Basal line variably distinct, geminate, included space usually paler. T. a. line outwardly oblique, curved between veins; sometimes obsolete, sometimes preceded by a pale shade. T. p. line about parallel with outer margin, dentate on veins, followed by white points. S. t. line pale, irregular, sometimes with an indistinct **W** mark, preceded by a series of more or less confluent blackish sagittate spots. A row of black terminal lunules. A broad variably distinct median shade darkens the cell between the ordinary spots, then runs rigidly oblique, and moderately close to t. p. line to hind margin. Claviform variable in size and shape; sometimes small, rounded, and again extending nearly across the median space. Orbicular oblong or oval, oblique, moderate in size, more or less white powdered. Reniform large, upright, variable in shape, with broad white powdery annulus and powdery brown center; secondaries fuscous, with paler, more yellowish fringes. Beneath paler than above, powdery, with variably distinct outer lines and discal dots. Head and thorax concolorous with primaries. Tuftings distinct but not prominent.

Expands 35 to 43 millimetres, 1.40 to 1.72 inches.

HABITAT.—Labrador, Greenland, Iceland.

The synonymy of this species sufficiently indicates its variability, but recognizing this, there is no difficulty in identifying the species, since it offers obvious differences from all the preceding.

For a fuller bibliography and for the authority for the synonymic references the student should consult Staudinger's Catalogue, which I have followed in this respect, and Walker's List and descriptions in the British Museum Catalogue. Nearly all the forms are credited to Labrador, and the species is not common in collections.

***Xylophasia sommeri* Lef.**

1836. Lef. Ann. Soc. Ent. Fr. v, 391, pl. 10, f. 1, *Hadena*.

1852. Gn., Sp. Gen. Noct. I, 187, *Crymodes*.

1856. Wlk., C. B. Mus. Lep. Het. ix, 220, *Crymodes*.

Paler grayish fuscous, the median space darker fuscous brown. Basal line geminate, distinct, included space pale, t. a. line outwardly curved between veins; geminate, the inner line obsolete, outer line black, included space pale, t. p. line obsoletly geminate, the outer line indistinct, included space pale, widely projected outwardly over the cell, dentate on veins, then with an inward curve to hind margin. S. t. line pale, distinct, sinuate, and in veins three and four dentate, preceded by fuscous, more or less sagittate spots. A paler shade at base of fringes, in which is a row of small terminal black dots. A rather faint median shade line between the ordinary spots and then close to t. p. line to inner margin. Claviform rather large, extending nearly across

the median space; concolorous, black ringed. Orbicular large, oval, oblique, pale. Reniform large, upright, pale, with fuscous inner line and powderings. Secondaries pale fuscous, darker outwardly, with a distinct dusky line. Beneath pale, powdery, with outer line and discal dot. Head and thorax concolorous, tuftings distinct.

Expands 40 millimetres = 1.60 inches.

HABITAT.—Labrador, Greenland, Iceland.

I have seen the ♀ only, and the insect seems rare. The dusky median space allies the insect to the preceding section, but the pale terminal space and punctiform or broken shade preceding the s. t. line are characteristic of the present group. It is not improbable that this is also a form of *exulis*.

Group *arctica*.

The species of this group are of large size; robust, with apices of primaries well marked, fringes slightly but perceptibly scalloped, hind angles somewhat retracted, and abdomen elongate and conic. The thoracic tufts are dense, the anterior divided crest not prominent, but the basal tufts very well marked; the abdominal tufts are prominent. They agree in essential features of maculation, the s. t. space being rather paler, sometimes contrasting and the terminal space uniformly darker. The reniform is always more or less white marked, and the general resemblance to *arctica* is obvious at a glance in all the species save *occidens*, which, however, is not likely to be referred elsewhere even though somewhat aberrant in color.

The genitalia of those species of which the males are known are of the normal *Hadenoid* type, though differing in detail.

Arctica is so well known that it scarcely requires description, the deep red-brown median space and contrasting blue-gray s. t. space are characteristic. The outer margin of tip of male harpe is densely fringed with spinules, and the inner inferior angle has a small brush of smaller spines continued sparsely along the inner margin and more dense near the superior angle, which is narrow. The clasper is slender, extending to the end of the tip.

Albina replaces the deep red brown by a more yellowish brown, and the s. t. space is still more yellowish, with a bluish-white shade opposite hind angle. The s. t. line is yellowish, and has a distinct though not prominent **W** mark on veins three and four, not so marked however to cause any doubt as to which group it should be referred. The tip of male harpe is smaller, the outer margin less rounded, and the brush of spinules at the inner inferior angle larger and more dense. The superior angle is rather broad and deeply excavated, the clasper moderate, and reaching to end of harpe. The species is well distinguished from *castanea*, to which Mr. Grote had referred it.

Castanea is darker, more evenly colored than either of the preceding, and the s. t. space is but little paler. The terminal space is darker,

however, and the reniform is white marked. The tip of male harpe is very like that of *arctica*, and the arrangement of spinules is similar, the superior angle is somewhat drawn out and ladle shaped. The clasper is very long and slender, extending beyond the end of tip.

Occidens, with an obvious agreement of essential characters, is pale gray in color, and the t. p. line is strongly retracted below the reniform. Mr. Grote says that some specimens have the median space brownish, and that the resemblance to *arctica* is obvious, but no such specimens have been seen by me. The ♂ has not been examined.

SYNOPSIS OF SPECIES.

Deep red brown median space, and contrasting pale blue-gray s. t. space....*ARCTICA*
 Yellowish brown, s. t. space paler, blue gray only opposite hind angles, a small W
 mark in s. t. line.....*ALBINA*
 More evenly dark brown, s. t. space but little paler, s. t. line evenly sinuate
*CASTANEA*
 Pale ash gray, t. p. line strongly retracted below reniform*OCCIDENS*

Xylophasia arctica Bdv.

1840. Bdv., Gen. et Ind. Meth. 120, *Hadena*.
 1845. H. S. Schmett, Eur. II, 272, pl. 31, f. 155, *Polia*.
 1852. Gn., Sp. Gen. Noct. II, 193, *Mamestra*.
 1856. Wlk., C. B. Mus. Lep. Het. IX, 225, *Mamestra*.
 1869. Minot, Can. Ent. II, 28, *Mamestra*.
 1870. Saund., Can. Ent. II, 75, *Mamestra*.
 1874. Grt., Buff. Bull. II, 14, *Hadena*.
amputatrix Fitch.
 1856. Fitch, 3d Rept. Ins. N. Y., 425, *Hadena*.
 1869. Riley, 1st Rept. Ins. Mo., 37, *Hadena*.
 1873. Grt. Buff. Bull. I, 108, pr. syn.
amica Harr.
 1862. Harr., Inj. Ins., Flint ed., 450, f. 222, *Hadena*.
 1873. Grt., Proc. Bost. Soc. N. H. XVI, 241, pr. syn.

Deep purplish or carmine red, basal and s. t. spaces more or less bluish gray; terminal space darker, more blackish. Basal line present, geminate. T. a. geminate, dentate on veins; t. p. line crenate, obsoletely geminate, sinuate; s. t. line pale, irregularly sinuate, preceded by a rusty-brown shade. Apex pale powdered. A row of small dark terminal dots. A pale line at base of fringes. A faint median line between the ordinary spots. Claviform concolorous, very faintly marked. Orbicular oval, somewhat oblique, more or less pale powdered. Reniform large, upright, always with a white spot inferiorly and usually filled with whitish spots or scales. Secondaries smoky; outwardly darker; discal lunule visible. Beneath with reddish powderings; an outer line and more or less evident discal dot. Thorax with dorsal tuft feruginous, basal tuft blue-gray, abdominal tufts prominent.

Expands 40 to 48 millimetres, 1.60 to 1.90 inches.

HABITAT.—United States to Rocky Mountains.

This common and widely distributed species hardly needs detailed description. The deep red of median space, contrasting s. t. space, and dark terminal space are characteristic. Western specimens as a rule run much paler than those from the East. Its life history has been written in economic publications.

Xylophasia albina Grt.

1874. Grt., Buff. Bull. II, 157, *Hadena*.

1881. Grt., Bull. U. S. Geol. Surv. VI, 263, a var. *castanea*.

Luteous or rusty brown, often darker, sometimes with a more carmine suffusion. Beyond the reniform the wing is paler, more yellowish, and opposite internal angle there is a bluish-white patch beyond t. p. line. Basal line geminate, distinct; t. a. line geminate, outwardly curved between veins. T. p. line geminate, interior line darker; outwardly bent over cell, and marked on veins, strongly incurved in submedian interspace. S. t. line broad, of pale ground color, marked by a continuous brown preceding shade and the darker terminal space, its course irregularly sinuate, forming a distinct though not prominent **W** on veins three and four. A row of black terminal dots. Basal space often with a paler yellowish shade. Claviform large, concolorous, black ringed, extending nearly across the median space. Orbicular slightly paler, large, oval, oblique. Reniform large, upright, strongly white marked—always with at least a white center. Secondaries pale ochery fuscous with broad dark outer border, an inner dusky line and discal lunule. Beneath reddish powdery, with outer dusky line and lunule. Dorsal tufts of thorax pale, somewhat discolorous; basal tufts trilobed, prominent; abdominal tuftings prominent.

Expands 44 to 48 millimetres, 1.75 to 1.90 inches.

HABITAT.—California.

Closely allied to *arctica*, but sufficiently distinct by the entirely different ground color, and characters elsewhere pointed out.

Xylophasia castanea Grt.

1874. Grt., Buff. Bull. II, 156, *Hadena*.

cymosa Grt.

1881. Grt., Papilio I, 34, *Hadena*.

1881. Grt., Papilio I, 59, pr. syn.

1881. Grt., Bull. U. S. Geol. Surv. VI, 263, pr. syn.

Dark smoky brown, s. t. space hardly paler; termina. space darker. Basal line geminate, black. T. a. line geminate, blackish, outwardly bent, and somewhat indented on the veins. T. p. line geminate, outer line obsolete, its course nearly as in the preceding species. S. t. line yellowish, rather evenly sinuate, sometimes interrupted. A series of small black terminal dots. A fairly distinct median shade line from costa between ordinary spots and then close to and parallel with t. p. line to inner margin. Claviform moderate, concolorous, narrowly

black ringed. Orbicular concolorous or slightly paler, ovate, somewhat oblique. Reniform large, broad, outwardly white marked. Secondaries dusky, somewhat darker outwardly. Beneath, dusky, powdery; secondaries with discal line and spot. Thoracic tufts not discolorous; basal tufts sometimes ferruginous tipped.

Expands 43 to 50 millimetres, 1.75 to 2 inches.

HABITAT.—California, Washington.

Easily distinguished from all the preceding, and with a decided relation to some of the species of the next group.

Xylophasia occidentis Grt.

1878. Grt., Bull. U. S. Geol. Surv. iv, 177, *Hadena*.

Ash gray; median and terminal spaces and costal region, except at apex, darker. A brown shade occasionally in median space. Basal line geminate, marked on costa; a longitudinal black shade over vein 1. T. a. line rather even, with a slight outward curve; inner portion of line obsolete. T. p. line geminate at inception, the outer line becoming obsolete over cell. A strong outward curve over cell, and a deep inward angle below reniform to vein two; then outwardly oblique to hind angle. S. t. line regularly sinuate, broad, marked by a continuous dusky preceding shade and the darker terminal space. A faint dusky line nearly through middle of median space. Claviform small, concolorous, black ringed. Orbicular, large, pale. Reniform large, kidney shaped, pale, inferiorly touching the t. p. line. Secondaries grayish fuscous, darker outwardly. Beneath very pale gray, with dusky outer line and discal spot. Thoracic tufts concolorous.

Expands 42 to 44 millimetres; 1.70 to 1.75 inches.

HABITAT.—Nevada, Colorado.

I have seen only the ♀; but there is little doubt of its being structurally like its allies. Its gray color and peculiarly incurved t. p. line render it readily distinguishable.

Group *Perpensa*.

Only one species—*perpensa* Grt—is referred to here. It agrees with the following *W*-marked group in habitus and in the longitudinal shade through the center of primaries. The latter are shorter, more obtuse, the margin scalloped, and the hind angle retracted. These features really form the only basis for the group; but the insect is a peculiarly marked one fitting in no other category, and as the divisions are purely artificial and for convenience of recognition only, there is no objection to the course. The tuftings of thorax are distinct, but not prominent; those of abdomen well marked. The genitalia are essentially like these of the preceding. The upper angle of tip of harpes is broad, deeply excavated, the inferior margin nearly straight, fringed with spinules; the inner inferior angle with a bunch of longer spines. The

clasper is short, thick at base, rather abruptly narrowing to a rather acute tip. In color the species is dull fuscous, with black markings and veins. The orbicular is elongate oval and oblique.

Xylophasia perpensa Grt.

1833. Grt., Can. Ent. 13, 229, *Hadena*.

Dark blackish fuscous, the markings black. A short basal streak; another along inner margin. T. a. line blackish, diffuse geminate, outwardly oblique, forming a long tooth in submedian interspace, then abruptly inward, and again forming an outward dent below vein 1; the latter vein is black marked to t. p. line. A black shade connects the median lines in the submedian interspace. T. p. line geminate crenate, outwardly bent over cell, then obliquely and rather evenly to inner margin. The included space is somewhat pale powdered. T. p. line indefinite, marked only by a contrast in shade; the terminal space being darker. A row of terminal dark dots. Fringes scalloped, at hind angle retreating. Claviform barely indicated. Orbicular elongate oval, oblique, black ringed, concolorous. Reniform upright, somewhat narrowing superiorly; incompletely dark ringed; paler outwardly. Secondaries smoky fuscous, darker outwardly, fringes paler. Outer line and discal dot reflected from under side. Head and thorax concolorous with primaries; collar with a black line. Beneath pale, grayish fuscous, powdery toward costal margin and apices; an outer common line and discal spot more distinct on secondaries.

Expands 32 millimetres=1.30 inches.

HABITAT.—Arizona.

The distinctive features have been already sufficiently pointed out.

Group *cariosa*.

The distinctive character of this group is the indentation of the s. t. line on veins 3 and 4, forming a distinct **W**, and this character is common to all the species of this group, as well as to those of the group *inordinata*. There are no other characters peculiar to this group only, which is nevertheless a compact and closely related one. All the species except *cuculliformis* and *genialis*, in which the maculation is obsolete, have a slender black basal streak, and another, parallel, along the hind margin close to base, forming the inner part of t. a. line at that point. The genitalia of the ♂ agree with the general characters given in the description of the genus, but present individual differences of some interest.

Cuculliformis, with which I head the list, is very readily distinguished by the long narrow wings, recalling the genus from which this species derived its name, as well as by the absence of the ordinary transverse maculation. The ♂ is not known to me.

Verbascoides is closely allied, but evidently distinguished by the distinct black shade below the middle of the wing, and the outer margins

are less dentate. The color is brownish yellow like the preceding, but the costal region is paler. The ♂ genitalia are of the usual type, the superior angle of the trigonate tip is excavated, and gives rise to the moderately long, curved clasper; along the inferior margin of the tip is a series of stiff spinules, longer than those fringing the outer margin.

Nigrrior is larger and darker than the preceding but with similar maculation, and with the genitalia about alike. The white powdered t. p. line on the dark ground gives the insect a distinctive appearance. I have seen this form labelled *sectilis*, and also associated with *cariosa*, but it is very distinct from either.

Cariosa is distinguishable at a glance from the preceding by the distinctly marked ordinary spots, the orbicular round, and by the presence of the claviform. It is rather a broad-winged form, and the costal region is paler than the dark fuscous brown ground color. The genitalia are distinctive. The clasper is entirely wanting, the superior angle of the trigonate tip is excavate, and somewhat produced, beak-like. The outer margin is fringed with spinules, and the inferior angle is furnished with two stout short corneous spurs.

Idonea is similar, but smaller, darker, more obscure in every respect, the costal region is not paler, and the claviform extends nearly across the median space. No ♂ of this species has been examined.

Vulgaris is rather a broad-winged form with obtuse apices; dull luteous or fuscous brown, with an irregularly strigate appearance. The genitalia are like those of *verbascoides*, except that the clasper is shorter, and there is a small supplementary corneous projection behind the tip. The orbicular is decumbent.

Up to this point all the species have very distinct divided crests on the thorax, extending forward, partly overlooking the collar and reaching backward to the base. In the following species this crest is not nearly so prominent, though distinct, and does not form the prominent and striking feature that it does in the previous series.

Antennata is a dark form, with a deep red-brown suffusion, somewhat indistinct transverse lines, and a general resemblance to the *cariosa* type of maculation, differing in the decumbent orbicular, which is typical of all the following species of this group. The genitalia are close to those of *verbascoides*, save that the clasper is much longer, extending to the inferior angle of tip. The outer margin of tip is also straighter.

Cinefacta is at once different from all others in the group by the pale gray color with more or less luteous, or as Mr. Grote says, "olivaceous fuscous" suffusion, most distinct through the median space, but entirely lacking in two Colorado specimens that I cannot consider as distinct. The genitalia are peculiar. The tip has the angles rounded, the superior much prolonged, and forming a somewhat ladle shaped process. The clasper is short, very broad, conic rather beak-like, and there is another longer, more slender, curved corneous hook on the

side piece some distance from the tip. The outer margin of the tip has the usual fringe of spinules, and the inner edge has a series or rather a brush of small spines.

Auranticolor is a bright yellowish red-brown form, with violet powderings especially distinct along the inner margin and through s. t. space. It is very distinct from all the preceding, and forms the bridge to the other groups. No ♂ has been examined.

Lignicolor differs from all the preceding by the indistinct claviform, and lack of distinct connecting shade between the median lines. The color is more dull than in *auranticolor* but also very similar. The genitalia are as in *antennata*, the clasper somewhat dilated towards the tip.

Genialis is closely allied, but the maculation is obsolete. The genitalia are almost identically like those of *lignicolor*, and a comparison of the figures will show best wherein they differ.

Relicina is related to *cinefacta*, but is bluish gray, and has the median lines very strongly dentate, and so is easily recognizable.

Centralis is also related to *cinefacta*, but is a more whitish gray, with more even median lines, and an obviously darker, somewhat contrasting median space.

SYNOPSIS OF SPECIES.

Primaries narrower, sub-equal, margin strongly dentateCUCULLIFORMIS

Primaries wider, more trigonate; margin less, or not dentate.

A broad blackish shade between median lines not usually extending beyond the t. p. line.

Claviform wanting; t. a. line indefinite.

Yellowish brown, costal region palerVERBASCOIDES

Blackish brown, costal region not paler.....NIGRIOR

Claviform distinct; t. a. line usually well marked.

Orbicular round.

Costal region paler, maculation well definedCARIOSEA

Costal region concolorous, color more sordid, maculation less definite, claviform, extending nearly across median spaceIDONEA

Orbicular decumbent elongate.

Broader winged; dull, luteofuscos, strigate, t. p. line geminately punctiform superiorly; outer margin more dentateVULGARIS

Narrower winged, apices more produced, t. p. line not punctiform.

Fuscos brown, with a dark red-brown suffusionANTENNATA

Blue gray t. a. and t. p. lines strongly dentate and angulateRELICINA

Ash gray, with luteous suffusion through median space; ♂ antennæ thicker, t. a. line dentate below median vein onlyCINEFACTA

Pale ash gray, median space dark, t. a. line not dentateCENTRALIS

Reddish brown, bright; t. p. line accompanied by a bright violet shade often invading s. t. space.AURANTICOLOR

No black shade between the median lines.

Claviform indistinct or wanting; color pale leather brown.

Maculation distinctLIGNICOLOR

Maculation obsoleteGENIALIS

Xylophasia cuculliformis Grt.1875, Grt., Check List, 1875, 24, *Hadena*.

Luteous brown, pale; a dusky shade along internal margin, deepening outwardly to outer margin. A triangular dark brown shade above the **W** mark, its apex at t. p. line, gradually broader to outer margin. T. a. line obsolete. T. p. line geminate, with a wide outward curve over cell; continuous only at inception, then punctiform to hind margin; a white dot separates the dusky spots, and in the darker submedian shade takes the form of a narrow white line, crossing this shade. S. t. line indefinite, only the **W** being at all well marked. The fringes are dentate, darker brown, cut with ground color. The ordinary spots are concolorous and very indefinite; orbicular elongate, decumbent, extending to but not confluent with the reniform, which is moderate in size and normal in form; a blackish point marks its outer margin. The internal margin is marked with white scales. Secondaries very pale yellowish, semi-transparent, outwardly darker; beneath pale, with somewhat indefinite outer line and discal spot. Head and collar paler; the latter with a narrow black line. Thorax darker, the tuftings with a gray shade. The tuftings of abdomen are dark, very equal, and extend to the sixth segment.

Expands 43 millimetres; 1.65 inches.

HABITAT.—California.

Two ♀ specimens agree in all points, and are easily distinguished from their congeners by the narrower wings, the outer margin distinctly dentate. The rather prominent tuftings and quadrate thorax afford other distinctive features.

Xylophasia cristata Grt.1878, Grt., Bull. U. S. Geol. Surv., IV, 176, *Hadena*.

“♂ Thorax ferruginous, strongly crested; body comparatively slender; abdomen tufted; size large. Fore wings dusky ochreous, with all the markings dotted and fragmentary. Lines marked in black on costa. Reniform barely indicated with a black central dot. T. p. line a double series of black dots, the inner line represented by a white curved streak crossing a dark shade on submedian fold, thus allying the moth to *cuculliformis* and *verbascoides*. Terminally the wing is shaded blackish, twice more prominently at the middle and at internal margin across the narrow pale s. t. line. Fringes blackish, cut with ferruginous ochrey at end of veins. A fine ferruginous basal streak and internal margin shaded with rusty. Hind wings fuscous, with rusty-ochre fringes and shaded with ochre along external margin. Beneath pale ochre with rusty tinge; on hind wings a waved medial line marked in the veins, and a discal lunule. Primaries with lunule and straight line double and angulate at costa. *Expansion*, 45 millimetres. Buffalo. (A. R. Grote.)”

This was described by Mr. Grote from a species named but not published by Dr. Harvey. It must be a near ally of *euculliformis*, but I do not know it.

***Xylophasia verbascoides* Gn.**

1852, Gn., Sp. Gen. Noct., 1, 141, *Xylophasia*.

1856, Wlk., C. B. Mus. Lep. Heb., ix, 170, *Xylophasia*.

1873, Grt., Buff. Bull., 1, 109, *Hadena*.

Yellowish brown, with a richer longitudinal shade through the center and the costal region paler. The median lines are nearly obsolete. Basal line wanting. T. a. line marked by geminate dots on costa, subcostal and median veins. T. p. line unusually near to outer margin, consisting of a series of geminate venular dots to submedian space, where it forms a distinct pale lunule, margined by narrow black lines. The line makes a wide outward curve opposite the cell. S. t. line indistinct at inception, pale, strongly dentate on veins three and four, and there touching the outer margin. Orbicular very indefinite, concolorous, elongate, oblique. Reniform indefinite, upright, marked by blackish scales. A fine black basal streak, a black streak at inner margin near base. A broader black dash through submedian space, interrupted by the white lunule of t. p. line. Terminal space darker, except at apex. Median vein with a narrow black line, margined with white scales to its furcation; veins three and four similarly marked to the outer margin. Secondaries smoky fuscous, paler toward base, and with an obvious discal lunule. Secondaries brown, powdery, with distinct large discal spots. Head pale, vestiture of front tipped with black; collar brown, with an inferior white line, bordered above by a broader black line, tipped with white. The divided tuft is prominent, pale at the sides. Patagiae with a white marginal line and darker center. Dorsal tufts of abdomen distinct. Genitalia of the ♂ with a series of spinules at the inner inferior margin of the tip; a distinct moderately long clasper, not reaching to the end of tip.

Expands 37 to 42 millimetres; 1.50 to 1.70 inches.

HABITAT.—Middle and Eastern States.

A strongly marked and easily recognizable species. The pale color of the costal region, the dark brown and black longitudinal shades and streaks through the middle, and obsolete transverse maculation are distinctive. The species is not rare.

***Xylophasia nigrior* Smith, sp. nov.**

Pattern of maculation like that of *verbascoides*, but more distinct. Smoky brown with a distinct deep carmine tinge, costal region marked with pale scales to t. p. line. Basal line faintly marked, geminate. T. p. line marked with whitish scales, the geminate venular dots defining its course. All the veins black marked. Ordinary spots outlined by pale scales forming a rather broad but somewhat vague and incomplete ring; form as in *verbascoides*, and the longitudinal black marks and

shades are also similar. The black dash at inner margin near base is followed by a white shade, outwardly defined by a blackish line. Secondaries dark, smoky, paler toward base, fringe yellowish. Head and thorax and maculation of under side as in *verbascoides* but darker.

Expands 47 millimetres, 1.85 inches.

HABITAT.—Maine.

Closely allied to *verbascoides*, but yet distinguishable at a glance by the darker color and narrowly white-powdered costal space. The powdery pale t. p. line is also distinctive. The type is a fine specimen from Mr. Thaxter, and I have seen others in his collection and in those of Mrs. Fernald and Mr. Eddy, of Bangor.

Xylophasia cariosa Gn.

1852. Gn., Sp. Gen. Noct. I, 144, *Xylophasia*.

1856. Wlk. C. B. Mus. Lep. Het. IX, 178, *Xylophasia*.

1873. Grt., Buff. Bull. I, 109, *Hadena*.

1874. Grt., Can. Ent. VI, 15, *Hadena*.

Fuscous gray, the terminal space darker, and a darker shade through median space, often with a variably deep red-brown tinge throughout. Basal line geminate, marked on costa only. T. a. line fairly distinct, geminate, waved, outwardly bent to submedian vein, then with a long inward streak, defined by a distinct black dash, to the inner margin near base. T. p. line geminate, even; outer line punctiform; strongly bent over cell, thence nearly parallel with outer margin. S. t. line indefinite at inception, indenting the terminal space on veins 3 and 4, to form the **W** mark peculiar to the group. A row of black terminal lunules. A fairly distinct shade line through median space, starting from the costa at its middle, obliquely outward, touching reniform inferiorly nearly to t. p. line, thence parallel with and close to t. p. line to hind margin. A black basal streak, beneath which the basal space is darker. Claviform distinctly outlined, obscured by a dark shade, which extends to the s. t. line, interrupted by the t. p. line. Ordinary spots concolorous, distinctly outlined, orbicular rounded, reniform upright, oblong. Head and thorax essentially as in the preceding species. Secondaries smoky fuscous with yellow fringes. Beneath rather pale, powdery, with very distinct outer line on both wings and distinct discal spot on secondaries.

Expands 35 to 38 millimetres, 1.40 to 1.55 inches.

HABITAT.—Northern, Eastern, and Middle States to North Carolina.

Not uncommon, and readily distinguished from the preceding by the distinct claviform.

Xylophasia idonea Grt.

1882. Grt., Can. Ent. XIV, 18, *Hadena*.

Even obscure fuscous gray, with the maculation essentially as in *cariosa*, but much less defined. The claviform extends nearly across the median space, the longitudinal shade is indefinite, the s. t. line is

inwardly defined by a row of confluent dusky spots, and outer portion of the t. p. line is continuous and not punctiform. Otherwise everything as in *cariosa*.

Expands 38 millimetres, 1.55 inches.

HABITAT.—Texas, Arizona, Wisconsin.

This is the Western representative of *cariosa*, but undoubtedly distinct from it. The more even dull ground color, the long claviform, and even t. p. line are distinctive features. It seems not common.

Xylophasia vulgaris G. & R.

1866. Grt. and Rob., Proc. Ent. Soc. Phil. VI, 19, pl. 3, f. 2, *Xylophasia*.

1873. Grt., Buff. Bull. I, 110, *Hadena*.

1874. Grt. 6th Rept. Peab. Ac. Sci. 32=*Xylina socia*.

Luteous brown, rather sordid; the veins black marked; terminal space darker. Transverse maculation indistinct. Basal line geminate, marked on costa only. T. a. line geminate, irregularly dentate, more or less obsolete through middle of wing. On the hind margin the inner portion of line forms the usual black dash, which reaches nearly to base. T. p. line geminate, punctiform except through submedian interspace, where it interrupts the longitudinal black shade which extends from the orbicular to s. t. line. S. t. line as in *cariosa*, preceded by a darker shade, sometimes forming blackish spots. A row of black terminal lunules. The median shade is indefinite, visible only between the ordinary spots. Claviform rather indefinitely outlined, but always present. Orbicular decumbent elongate; reniform upright, rather vaguely defined. Secondaries and under side as in *cariosa*. Head and thorax also marked as in *cariosa*, save that the ground color is more reddish brown.

Expands 40 to 45 millimetres; 1.60 to 1.80 inches.

HABITAT.—Middle and Eastern States, Washington.

Strongly resembles *cariosa*, but obviously distinct by the different ground color and decumbent orbicular. It is not common.

Mr. Grote, in the Sixth Rept. Peab. Ac. Sci., 32, refers this species as a synonym of *Xylina socia* Hufn. and in the Catalogue in Buff. Bull. II, he makes the same reference. In the list of 1875 this synonymy is abandoned, and has not since been referred to. This species is certainly no *Xylina*.

Xylophasia antennata Smith, sp. nov.

Fuscous brown, with a brighter red-brown suffusion, s. t. space powdered with whitish scales. Basal line geminate, blackish. T. a. line geminate, superiorly obsolete, outwardly curved in submedian space, inwardly bent below vein 1; here marked with white scales and by the usual black dash. T. p. line geminate at inception, and very indistinct to vein 4; thence single, black, distinct, somewhat produced on the veins. S. t. line somewhat paler, with W mark distinct; terminal space darker; a fine black terminal line, followed by a pale line at base of

fringes. Claviform small, connected with t. p. line by a distinct black shade. An indefinite dark median shade. Ordinary spots, somewhat paler, indistinctly outlined. Orbicular oblique, elongate, reniform upright. Secondaries smoky fuscous, paler towards base. Beneath with carmine powderings; an indefinite dusky common line and discal spot. Head and thorax deep brown, collar and patagia with darker lines.

Expands 38 millimetres, 1.50 inches.

HABITAT.—California.

A single ♂ specimen in collection of U. S. National Museum, from the Riley Collection.

Xylophasia relicina Morr.

1874. Morr., Pr. Bost. Soc. N. H. xvii, 216 *Hadena*.

1882. Grt., List 1882, *Luceria*.

“Expanse 40 millimetres. Length of body 22 millimetres.

“Eyes naked. The antennæ of the male with fine hairy clothing. The palpi and front as usual in the genus. The collar and pterygodes black, the former with a distinct transverse black line; behind the collar a low longitudinally furrowed tuft. The abdomen with short tufts on the first three segments. Ground color of the anterior wings light gray, variegated with darker gray and black; a distinct basal dash, and beneath the submedian nervure another similar dash; the median lines black, single, and strongly dentate; the interior line forming two conspicuous teeth on the costa, the lower one touching the orbicular spot; to the lobe between the median and submedian nervures the strongly marked black-lined claviform spot is attached, and extends to the exterior line; beneath the submedian nervure the lines are again connected by a long, sharp tooth; the exterior line is intercepted on the costa above the reniform spot; below its teeth are short and regular, but it forms one very sharp inward indentation, reaching the reniform spot; the ordinary spots concolorous, with black annuli; the orbicular oblique, the reniform upright, with its annulus outwardly obsolete; the terminal portions of the nervules tinged with black; the subterminal line whitish, very jagged, marked chiefly by the contrast between the light subterminal and the dark terminal spaces; a series of triangular dots at the base of the fringe, which is dark, intersected with light. The posterior wings white, with a very faint terminal border, and a black line at the base of the concolorous fringe. Beneath whitish, the anterior wings with a discal dot and median line.

“HABITAT.—Waco, Texas.

“This beautiful and distinct species belongs to the section *Xylophasia*, and is related to *H. lignicolor*, but the markings are more acute, and the ground color is gray, without brown or ochreous admixture.”

Mr. Grote referred this species to *Luceria*; why, I can not see. A single ♀ only is before me, but from that I should have no hesitation in referring it to this series. The strongly dentate median lines are characteristic and thus far unique in the genus.

Xylophasias cinefacta Grt.1881. Grt., Papilio 1, 77, *Hadena*.

Ash gray, pale, powdery; more or less suffused with luteous, most evidently so in the median space; terminal space darker. Basal line obsoletely indicated. T. a. indistinctly geminate, strongly angulate in submedian space, and somewhat confused and indefinite to the hind margin. The basal space is strongly white-powdered. T. p. line nearly parallel with outer margin, slightly produced on the veins. S. t. line pale, incomplete, with the usual **W** mark; through the middle of the wing preceded by a dusky interrupted shade. The s. t. space is pale, the veins flecked with black scales. A black basal streak. Claviform usually extending nearly across the median space, a dark shade line completing the connection. Orbicular elongate, oblique, sometimes confluent, with the upright reniform. A faint median shade crosses between the spots, sometimes darkening the outer portion of median space. Secondaries fusco-luteous, paler toward base. Beneath, pale, powdery, with somewhat indefinite outer line and discal spot. Head and thorax concolorous, collar and patagiæ with black line.

Expands 35 to 40 millimetres, 1.40 to 1.60 inches.

HABITAT.—Washington, California, Colorado.

The specimens from Colorado differ in lacking all yellow shade, but not in structure or maculation so far as observable. I have seen no specimens from Washington. The type from Mr. Edwards's collection is marked "So. Calif."

Xylophasias centralis Smith, sp. nov.

General color of head, thorax, and primaries whitish with a variable tinting of luteous. Collar with a central black line, patagiæ black margined. Primaries with a narrow black basal streak below median vein and another along internal margin. Along costa and inner margin the pale basal space is slightly clouded. Basal line geminate, indistinct. T. a. line geminate, outer part distinct, black, inner vague, powdery; the line outwardly oblique, slightly curved, somewhat irregular, but nowhere dentate or angulate. T. p. line as a whole almost parallel with outer margin after the usual bend over reniform; geminate, outer line not distinct, inner line but slightly crenulate over reniform, else even. A distinct, broad median shade from costa between the ordinary spots outwardly oblique to vein 2, there angulate and then parallel with and close to t. p. line to inner margin. S. t. line white, irregular, the **W** mark prominent, preceded by two distinct black sagittate marks. The line is preceded by a luteo-fuscous shade, variably distinct, the s. t. space else whitish. A row of black terminal lunules, fringes cut with white. Terminal space, except apical patch, dusky. Median space dusky, with a slight fuscous tinge. Orbicular oval, complete, oblique, concolorous, with a darker fuscous central spot. Reniform large, broad, upright, somewhat dilated inferiorly, pale marked, the

space beyond it of the pale ground color, sometimes obscuring the t. p. line at that point. Claviform distinct, narrowly black margined, concolorous, the inferior border continued to connect the median lines. Secondaries fuscous, with paler fringes. Beneath smoky, secondaries more powdery, with an outer line and discal spot.

Expands 1.60 to 1.75 inches, 40 to 44 millimetres.

HABITAT.—Sierra Nevada, California.

Several specimens of both sexes sent me by Mr. Hy. Edwards. The species is a distinct one, allied to *cinefacta*, than which this is a larger form, differing in the distinctly darker median space and obvious median shade. There are no angulations to the t. a. line, and the genital structure of the male is distinctive. It is scarcely possible to confuse this with any other of our described species.

Xylophasias auranticolor Grt.

1873 Grt., Buff. Bull. I, 109, *Hadena*.

Rather bright pale red-brown, with more luteous shadings and violet powderings. T. a. line geminate, with a wide outward curve in submedian space and a long inward bend below vein 1, where it is marked with violet scales, preceded by the usual black dash; else the included space is yellowish brown. T. p. line outwardly curved over reniform, thence parallel with outer margin; geminate, tolerably even, the included space violet powdered, this color sometimes extending through and suffusing the s. t. space. S. t. line yellow brown, with the usual W mark distinct; preceded by darker-brown shades. S. t. space sometimes violet powdered, but usually where the violet powderings encroach on the s. t. space the terminal space is darker brown. Fringes checked with ferruginous; a fine black terminal line. A black basal streak. Claviform paler, black margined, a brown shade connecting it with the t. p. line. Ordinary spots paler, large, dark ringed. Orbicular elongate, oblique, reniform upright, kidney shaped. A faint median shade, distinct only on costa; hind margin with violet powderings. Secondaries smoky fuscous, with reddish fringes. Beneath red brown, powdery, with dusky outer line, and discal dot on secondaries. Head and thorax concolorous with primaries, powdered with violet.

Expands 39 to 45 millimeters, 1.55 to 1.80 inches.

HABITAT.—Colorado and Washington.

A handsome and distinctly marked species which is not common in collections.

Xylophasias lignicolor Gn.

1852. Gn., Sp. Gen. Noct. I, 140, *Xylophasias*.

1856. Wlk., C. B. Mus. Lep. Het. IX, 176, *Xylophasias*.

1873. Grt., Buff. Bull. I, 109, *Hadena*.

1879. Strk., Rept. Chief Eng. 1878-'79, v, 186, *Hadena*.

var *quærita* Grt.

1876. Grt., Can. Ent. VIII, 26, *Hadena*.

1877. Grt., Can. Ent. IX, 197, pr. var.

Varies from pale luteous to dark leather brown. Apex and an irregular large blotch beyond reniform, paler; terminal space darker. Transverse maculation indistinct. T. a. line geminate, irregularly dentate, well marked only below vein 1, where it is preceded by the usual dark streak. T. p. line geminate, rather even, interrupted, outer line punctiform beneath vein 5, included space somewhat paler than ground color. S. t. line pale, distinct throughout. **W** mark distinct, preceded by an irregular dark shade, which in the costal region extends to the t. p. line. Claviform faintly marked, a slightly darker brown shade indicating the position of the ordinary black dash. A dark basal streak. Ordinary spots moderately defined; orbicular variable in size, oblique, elongate; reniform upright, inferiorly dark filled. A row of terminal black lunules; fringes dark, cut with pale. Secondaries fuscoluteous, paler at base. Beneath reddish, powdery, with common line and discal spot. Head and thorax concolorous with primaries, patagiae darker margined.

Expands 42 to 47 millimetres, 1.68 to 1.88 inches.

HABITAT.—Canada, Eastern, Middle, and Western States, Arizona, Colorado.

Rather a common and widely distributed species. The name *quærita* was applied by Mr. Grote to dark, well marked specimens with smaller orbicular.

Xylophasia genialis Grt.

1874. Grt., Buff. Bull. II, 66, *Hadena*.

Pale leather brown with the maculation subobsolete. The s. t. line is usually paler and fairly distinct, the **W** mark evident. S. t. space usually with darker powderings. The maculation so far as it is traceable is like that of *lignicolor*. It also bears a resemblance to *dubitans*, from which it may be distinguished by not having the reniform white marked, and the distinct **W** of s. t. line.

Expands 42 to 47 millimetres, 1.68 to 1.88 inches.

HABITAT.—California.

The species is not common, and has been already sufficiently distinguished from its allies.

Group *inordinata*.

Two species referred to this group differ from all the others belonging to the genus by brownish-yellow secondaries and distinct white maculation of primaries, the **W** mark of the s. t. line being distinct. The ♂ antennae have the joints marked, and they are furnished with lateral tufts of bristly hair. The genital parts of one of the species is like those typical of the group, and there is in addition to the stout clasper, which is close to the tip, another stout, more slender, corneous hook, rather enlarging toward the tip. The superior apex of tip is deeply excavated and the fringe of spinules is rather sparse. The species belonging here are very readily distinguished and are interesting by their peculiar variations.

Inordinata was described from Massachusetts, and the type is like

the ordinary Eastern form; the yellow pale, the white powderings rather dense, the transverse lines broad, and the dusky median line of secondaries distinct. The head is fairly prominent, though smaller and more retracted in the ♀; the thoracic tufting is distinct, and the secondaries beneath have a distinct though interrupted outer line. In Colorado occurs a form of what I take to be merely a variety of the Eastern form, but which may eventually prove distinct. It is somewhat smaller, the head is more retracted, thoracic tufting less decided, the ground color much deeper, more orange yellow, white lines narrower, powderings sparse.

The outer dark margin of secondaries is more intense, the inner line very faint and close to the outer band. Beneath there is *no* extra median line, and the marginal dark shade on both wings is strongly marked. These differences seem permanent in the series before me, but I can not convince myself they are specific, and propose the term *montana* for the variety.

Semilunata Grote is smaller than the preceeding, the head is still smaller, more retracted with a strong suggestion of *Anarta*, heightened by the loose, indistinctly tufted thoracic vestiture, and the abdomen is smooth, scarcely tufted in the ♀, and dark. The primaries are of a sordid blackish fuscous, the white lines often obscured, the yellow faint and pale, sometimes hardly traceable, while the secondaries are also pale and lack the median narrow line, though it is sometimes indicated. Beneath it is very pale, and the outer common line is wanting.

To a great extent the Colorado specimens fill the gap between this species, found only in Washington thus far, and the eastern *inordinata*, but the very pale color, sordid blackish suffusion, and *anartiform* appearance is distinctive, and probably three species will be eventually recognized.

***Xylophasia inordinata* Morr.**

1875. Morr., Proc. Ac. N. Sci. Phil. 1875, 63, *Hadena*.

Brownish yellow, varying from a shade verging on luteous to nearly orange shaded with black and white to a greater or less extent. Median lines geminate, very narrow, darker, included space white and prominent, giving the appearance of simple white lines. T. a. line sinuate and outwardly arcuate; t. p. distinctly angulate beyond the cell, thence rather evenly oblique to hind margin. S. t. line distinct, marked with white scales; W mark prominent; line preceded by a series of black sagittate marks. A row of black terminal lunules. Basal line very indistinct, pale, angular; basal space more or less powdered with black and white scales, sometimes the one, sometimes the other predominating. Costal region usually white powdered to the apex. The median space is black shaded, leaving a central space and the region beyond reniform, of ground color. S. t. space more or less powdered. Terminal space, except at apex, uniformly darker. The ordinary spots are very variable in size and form, usually with darker center and white annuli, sometimes entirely white. Secondaries dull yellow with broad

black margin, a fine median dark line, and a distinct discal lunule. Beneath paler yellow, with distinct common line and discal lunules and broad faint powdery dark margin.

Expands 32 to 35 millimetres, 1.28 to 1.40 inches.

HABITAT.—Massachusetts, Maine, Colorado.

The thorax is of the ground color, collar with base and tip whitish, patagiæ with white tips, preceded by a dusky line.

Xylophasia semilunata Grt.

1881. Grt., Papilio I, 58, *Hadena*.

Sordid blackish fuscous over a yellowish base; maculation white, interrupted, pattern as in *inordinata*. Thoracic tuftings indistinct, vestiture somewhat divergent, short; color uniformly dark. Secondaries without the median dark line, else as in *inordinata*. Beneath pale yellow with dusky margins and large discal spot, but no common exterior line.

Expands 28 to 30 millimetres, 1.12–1.20 inches.

HABITAT—Washington.

The differences between this and *inordinata* are elsewhere detailed.

SPECIES UNKNOWN TO ME.

Xylophasia libera Wlk.

1856. Wlk., Cat. Brit. Mus. Lep. Het. IX, 179.

“Testaceo-cana; thorax fascia vittisque duabus nigris; alæ anticæ disco et margine exteriore ex parte fuscis nigro strigatis, strigis duabus lunulisque marginalibus liturisque costalibus nigris, annulis discalibus nigromarginatis; posticæ cinereæ, ciliis pallidis,”

“*Xylophasia cariosa*?”

“*Male*. Testaceous, hoary. Thorax with a black band in front, and with a black stripe on each side. Fore wings partly brown, and streaked with black in the disk and along the exterior border, in the middle of which there are two lanceolate streaks; a row of blackish marks along the costa; discal ringlets with black borders; exterior border with black lunules. Hind wings cinereous with pale ciliæ. Length of the body 5 to 6 lines, of the wings 14 lines.”

“New York.”

It is scarcely likely that this description refers to any species not herein described under some other name, and probably Walker's own suggestion of *cariosa* is the true one.

Mr. Grote (Ill. Essay 44), refers this to *Mamestra grandis*, as a synonymn; but the description can scarcely be tortured into application to that species, while it does agree very well with *X. cariosa*.

Xylophasia infixa Wlk.

1856. Wlk., Cat. Brit. Mus. Lep. Het. IX, 178.

“Subcervina; caput et thoracis fascia fuscescentia; alæ anticæ punctis costalibus, vitta discali striga posteriore strigisque exterioribus nigris; posticæ pallide cinereæ, marginibus latis fuscescentibus.”

"Pale dead-wood color. Head and band of the thorax brownish. Fore wings with some black costal speckles, and with a black stripe traversing the discal ringlets, and with exterior black streaks. Hind wings pale cinereous, with broad brownish borders. Length of the body 5 lines; of the wings 12 lines."

"A. Florida."

This gives the impression of a species of *Homohadena*, but no transverse maculation is mentioned. It will be difficult to identify without reference to the type.

LIST OF SPECIES OF HADENA.

[Starred (*) species represented in the Museum collection.]

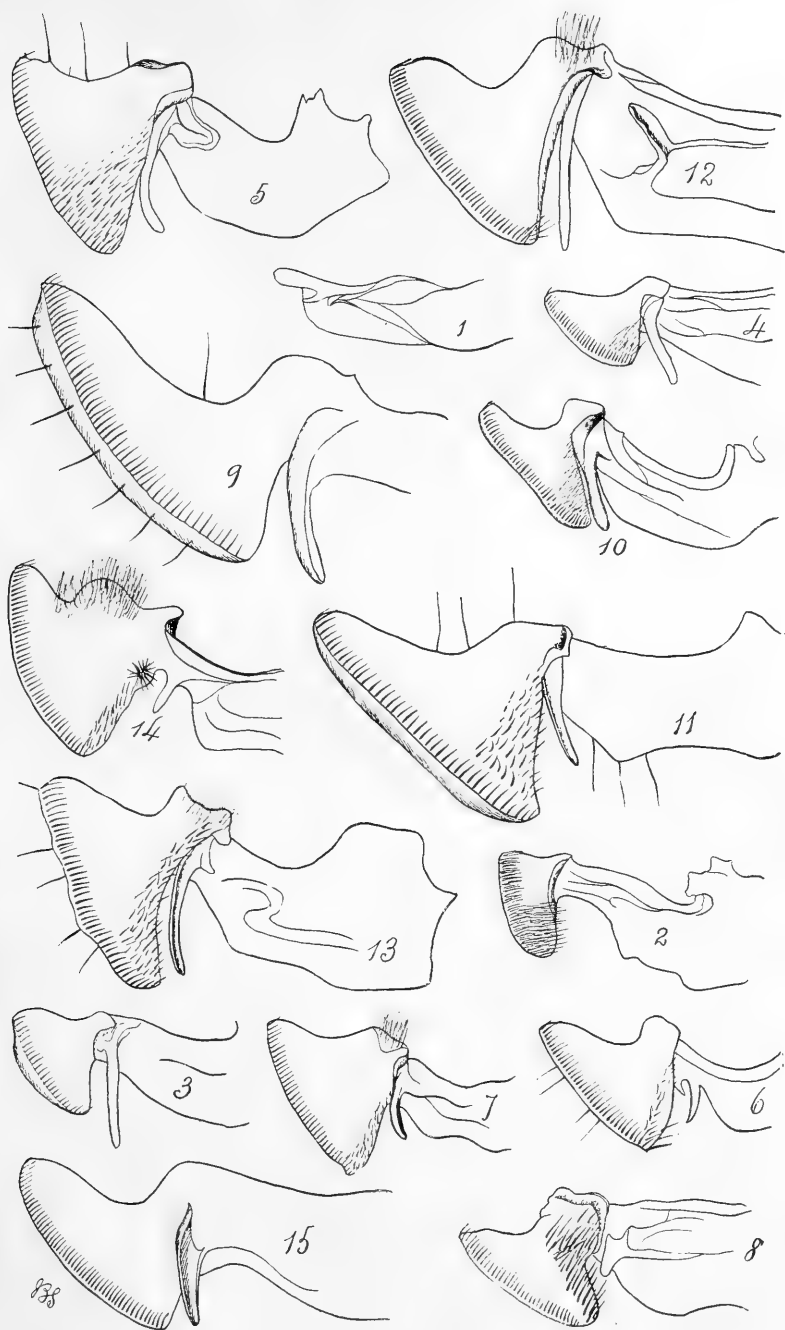
- | | |
|-------------------------------|------------------------------|
| § <i>Luperina</i> Boisd. | X. <i>EXULIS</i> Lef.* |
| L. <i>NIVEIVENOSA</i> Grt.* | <i>gelata</i> Lef. |
| L. <i>STIPATA</i> Morr.* | <i>grænlantica</i> Zett. |
| L. <i>PASSER</i> Gn.* | <i>cervina</i> Germ. |
| <i>loculata</i> Morr. | <i>marmorata</i> Zett. |
| var <i>CONSPICUA</i> Morr. | <i>diffusa</i> Geyer. |
| L. <i>BURGESSI</i> Morr.* | <i>gelida</i> Gn. |
| <i>discors</i> Grt. | <i>poli</i> Gn. |
| L. <i>LONGULA</i> Grt.* | <i>borea</i> Gn. |
| § <i>Xylophasia</i> Steph. | X. <i>SOMMERI</i> Lef. |
| X. <i>REMISSA</i> Hbn.* | X. <i>ARCTICA</i> Boisd.* |
| <i>indocilis</i> Wlk. | <i>amputatrix</i> Fitch. |
| X. <i>ILLATA</i> Wlk.* | <i>amica</i> † Harr. |
| <i>insignita</i> Wlk. | X. <i>ALBINA</i> Grt. |
| <i>suffusca</i> Morr. | X. <i>CASTANEA</i> Grt. |
| X. <i>VULTUOSA</i> Grt.* | <i>cymosa</i> Grt. |
| X. <i>APAMIFORMIS</i> Grt.* | X. <i>OCCIDENS</i> Grt.* |
| <i>contenta</i> Wlk. | X. <i>PERPENS</i> Grt. |
| X. <i>EXORNATA</i> Mœschl. | X. <i>CUCULLIFORMIS</i> Grt. |
| X. <i>HULSTII</i> Grt. | X. <i>CRISTATA</i> Grt. |
| X. <i>FINITIMA</i> Gn.* | X. <i>VERBASCOIDES</i> Gn. |
| X. <i>LATERITIA</i> Hufn.* | X. <i>NIGRIOR</i> Smith. |
| <i>molochina</i> Hbn. | X. <i>CARIOS</i> Gn.* |
| <i>insignita</i> Wlk. | X. <i>IDONEA</i> Grt. |
| <i>dubitans</i> Wlk. | X. <i>VULGARIS</i> G. & R.* |
| X. <i>COGITATA</i> Smith.* | X. <i>ANTENNATA</i> Smith.* |
| X. <i>MORNA</i> Strk. | X. <i>RELICINA</i> Morr.* |
| X. <i>SPUTATRIX</i> Grt.* | X. <i>CINEFACTA</i> Grt. |
| <i>insignita</i> Wlk. | X. <i>CENTRALIS</i> Smith.* |
| X. <i>PLUTONIA</i> Grt.* | X. <i>AURANTICOLOR</i> Grt.* |
| X. <i>ALTICOLA</i> Smith.* | X. <i>LIGNICOLOR</i> Gn.* |
| X. <i>DUCTA</i> Grt. | var <i>QUÆSITA</i> Grt. |
| <i>separans</i> Grt.* | X. <i>GENIALIS</i> Grt. |
| X. <i>IMPULSA</i> Gn.* | X. <i>INORDINATA</i> Morr.* |
| var <i>MIXTA</i> Grt. | var <i>MONTANA</i> Smith.* |
| X. <i>DEVASTATRIX</i> Brace.* | X. <i>SEMILUNATA</i> Grt.* |
| <i>ordinaria</i> Wlk. | SPECIES UNDETERMINED. |
| <i>contenta</i> Wlk. | X. <i>LIBERA</i> Wlk. |
| <i>abjecta</i> var † Gn. | X. <i>INFIXA</i> Wlk. |

EXPLANATION OF FIGURES TO PLATES 36 AND 37.

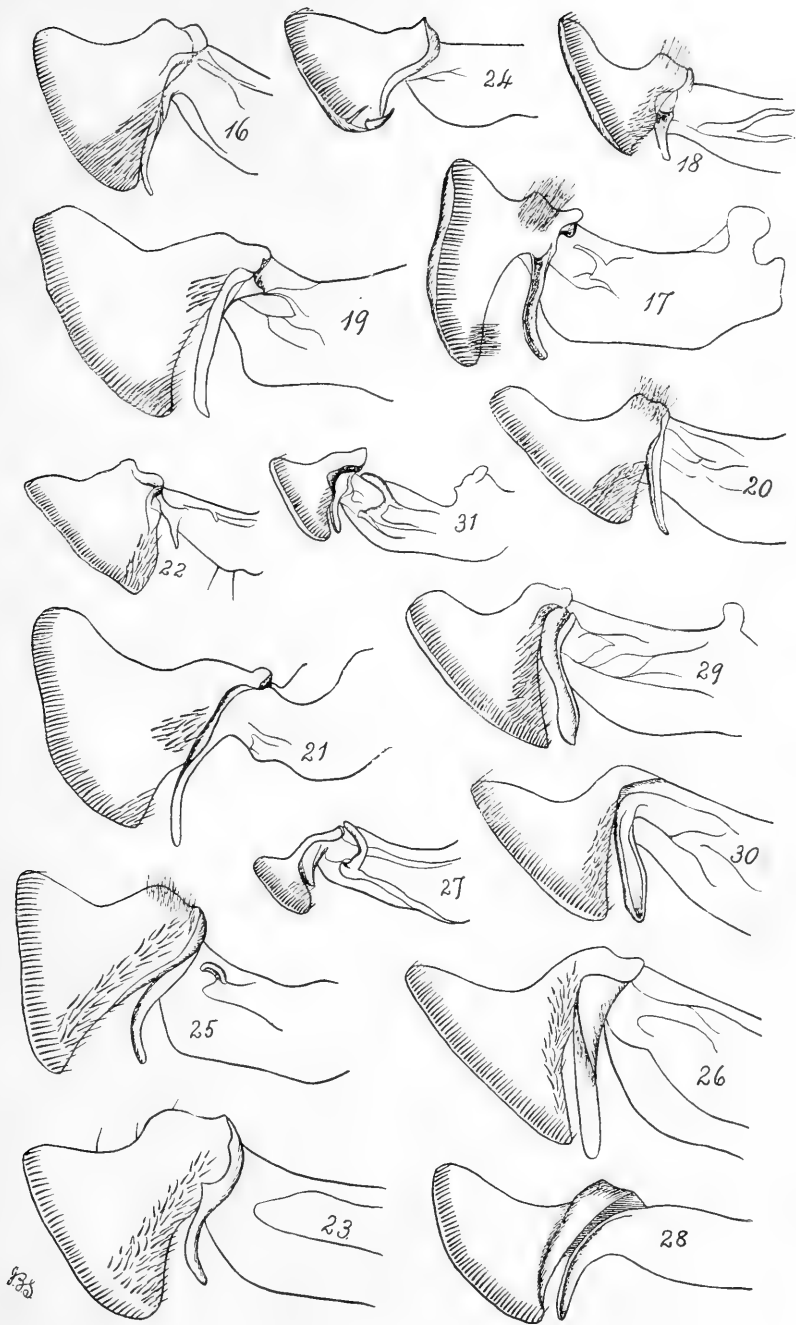
The figures are numbered consecutively, but are not regularly arranged on the plates. The right harpe and its attached processes are shown in each instance.

- | | |
|------------------------------------|--|
| 1. <i>Luperina stipata</i> . | 17. <i>Xylophasia devastatrix</i> . |
| 2. <i>Luperina passer</i> . | 18. <i>Xylophasia exulis</i> . |
| 3. <i>Luperina burgessi</i> . | 19. <i>Xylophasia arctica</i> . |
| 4. <i>Luperina longula</i> . | 20. <i>Xylophasia albina</i> . |
| 5. <i>Xylophasia remissa</i> . | 21. <i>Xylophasia castanea</i> . |
| 6. <i>Xylophasia illata</i> . | 22. <i>Xylophasia perpensa</i> . |
| 7. <i>Xylophasia vultuosa</i> . | 23. <i>Xylophasia verbascoides et</i>
<i>Xylophasia nigrior</i> . |
| 8. <i>Xylophasia apamiformis</i> . | 24. <i>Xylophasia cariosa</i> . |
| 9. <i>Xylophasia exornata</i> . | 25. <i>Xylophasia vulgaris</i> . |
| 10. <i>Xylophasia finitima</i> . | 26. <i>Xylophasia antennata</i> . |
| 11. <i>Xylophasia lateritia</i> . | 27. <i>Xylophasia cinefacta</i> . |
| 12. <i>Xylophasia cogitata</i> . | 28. <i>Xylophasia centralis</i> . |
| 13. <i>Xylophasia sputatrix</i> . | 29. <i>Xylophasia lignicolor</i> . |
| 14. <i>Xylophasia plutonia</i> . | 30. <i>Xylophasia genialis</i> . |
| 15. <i>Xylophasia alticola</i> . | 31. <i>Xylophasia inordinata</i> . |
| 16. <i>Xylophasia impulsu</i> . | |





GENITAL STRUCTURE OF LUPERINA AND XYLOPHASIA.



GENITAL STRUCTURE OF XYLOPHASIA.

SCIENTIFIC RESULTS OF EXPLORATIONS BY THE U. S. FISH COM-
MISSION STEAMER ALBATROSS.

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No. XIX.—A SUPPLEMENTARY LIST OF FISHES COLLECTED AT THE
GALAPAGOS ISLANDS AND PANAMA, WITH DESCRIPTIONS OF ONE NEW
GENUS AND THREE NEW SPECIES.

BY

CHARLES H. GILBERT,

Professor of Zoölogy, University of Indiana.

The collections of fishes made by the *Albatross* in 1887-'88, at the Galapagos Islands and in Panama Bay, were reported on by Jordan and Bollman in Proceedings of the U. S. National Museum, 1889, pp. 149-183. A small portion of the collection, however, failed to reach the authors in time for their report, and is here listed. It is noteworthy as containing the remarkable new genus *Dialommus*, which repeats in the *Blenniidae* the peculiar structure of the eyes seen in the Cyprinodont genus *Anableps*.

1. *Galeus dorsalis* Gill.

Numerous young specimens from Panama.

2. *Opisthonema libertate* Günther.

Three young specimens from Indefatigable and Chatham Islands. This seems to be the species listed by Jordan and Bollman as "*Clupea* sp. (very young)."

3. *Cyclothone lusca* Goode and Bean.

Four small specimens from Station 2806. This species, which seems to occur everywhere in deep water from the Galapagos Islands to Ber-
ing's Sea, I am unable to distinguish from the Atlantic form, to which it is here referred.

4. *Stolephorus opercularis* Jordan and Gilbert.

One specimen from Station 2802.

5. *Ophichthus triserialis* Kaup.

Two specimens from Chatham Islands. *Ophichthus rugifer* Jordan and Bollman, to which these specimens belong, seems not to differ from *triserialis*.

6. *Neoconger vermiformis* Gilbert.

A single specimen from Station 2799, agreeing perfectly with the original description.

7. *Ophiosoma nitens* Jordan and Bollman.

One young specimen from Stations 2799.

8. *Tylosurus stolzmanni* Steindachner.

From Chatham and Albemarle Islands. The young of this species have the lower jaw much longer than the upper.

9. *Fodiator acutus* Cuv. and Val.

Two specimens from Panama.

10. *Hemirhamphus roberti* Cuv. and Val.

Panama and Chatham Island.

11. *Hippocampus ingens* Girard.

One specimen from Station 2795.

12. *Querimana harengus* Günther.

Panama.

13. *Remora remora* Linn.

One specimen from Albemarle Island.

14. *Vomer setipinnis* Mitchill.

Stations 2797 and 2800.

15. *Stromateus palometa* Jordan and Bollman.

Three specimens, Station 2805.

16. *Epinephelus labriformis* Jenyns. = *Epinephelus sellicauda* Gill.

Six young specimens, Station 2797.

17. *Serranus psittacinus* Valenciennes.

One specimen Chatham Island.

18. *Priacanthus serrula* sp. nov.

A single specimen, 1 $\frac{3}{4}$ inches long, from Station 2797.

Head 2 $\frac{3}{8}$ in length; depth 1 $\frac{1}{8}$. D. X, 11; A. III, 11. Lat. 1. 36 (pores).

Mouth very oblique, the maxillary scarcely reaching vertical from middle of eye, half length of head. Teeth in a very narrow band in

both jaws and on vomer, none of them enlarged; palatines with a single series. Posterior nostril elliptical, not twice as long as it is wide. Eye $2\frac{1}{3}$ in head; interorbital width $3\frac{1}{3}$; length of snout 5.

Preopercular and preorbital margins serrate, a group of stronger spines at angle of preopercle. Gill rakers short, about half diameter of pupil, 16 developed on horizontal limb of outer arch.

Spinous dorsal high, the longest spine $\frac{5}{6}$ length of head; the first and last spines much shorter, about equaling the soft rays. Anal spines similar but shorter, the first two equal and longer than the third, their length half that of head. Pectorals short, barely reaching vertical from vent. Ventrals elongate, the spine reaching base of second anal spine, the longest soft ray reaching base of first soft ray of anal.

Scales on upper and lower parts of body very small, those on middle of sides conspicuously enlarged. Entire head, including maxillary, mandible, gular and branchiostegal membranes wholly covered with spiny scales. Dorsal and anal fins in a sheath. All spines rough-serrate.

Color in spirits: Light olive, with four dark cross-bars on sides wider than the interspaces, the last one on base of caudal peduncle. Ventrals dusky, the soft portions more or less speckled. Ventrals black. Pectorals pale.

19. *Lutjanus viridis* Valenciennes.

A single young specimen, $1\frac{1}{2}$ inches long, showing coloration of adult, the blue streaks being well marked. It agrees with all the characters ascribed to *viridis*, except the notched preopercle, the spines next the angle being all largely developed, and the margin of the bone showing no notch for the reception of an interopercular knob. This is doubtless due to the immaturity of the specimen.

20. *Apogon dovii* Günther.

One very young specimen from Station 2797.

21. *Upeneus grandisquamis* Gill.

Stations 2795 and 2797.

22. *Bollmannia chlamydes* Jordan.

Stations 2799 and 2800. Agreeing well with the original description, having 15 rays in the soft dorsal, and the black spot on spinous dorsal very distinct, ocellated posteriorly with white.

23. *Tyntastes brevis* Günther.

Two half-digested specimens, said to have been taken from the stomach of a *Centropomus* at Panama. The dorsal formula is apparently VIII, 14, and the head $4\frac{1}{4}$ in length. The teeth are long, wide-set, in a single series.

24. *Gobiesox zebra* Jordan & Gilbert.

Two young specimens, agreeing in all respects with the original description, except the fin formula, the dorsal having six and the anal five rays. The dark cross-bars are evident. Duncan Island.

25. *Labrosomus delalandi* Cuv. & Val.

One large specimen, $6\frac{1}{2}$ inches long, from Albemarle Island.

Dialommus gen. nov. (*Blenniidae*)

Teeth conic, strong, in a narrow band in the front of both jaws, this narrowing to a single series laterally; outer teeth enlarged in both jaws. Teeth on vomer in a single series; palatines smooth.

A single slender tentacle above orbits, and one on each side of nape.

Body with moderate cycloid scales; lateral line high in front, declining behind pectoral fins, not strongly developed, evident on a few scales near head, the remainder of its course traceable by occasional pores on bases of scales, or by their notched margins.

Dorsal beginning on the nape, its anterior five-sevenths composed of slender flexible spines, the remainder of soft rays, unbranched. Anal without spines. Caudal distinct, rounded. Ventrals well developed, I, 3.

Eyes as in *Anableps*, the cornea divided by an oblique pigmented band into an anterior lower and a posterior upper half.

(Type, *Dialommus fuscus* sp. nov.)

26. *Dialommus fuscus* sp. nov.

Elongate, slender, scarcely tapering. Head short, transversely evenly rounded, with very short, blunt, decurved snout. Width of head greater than its depth, and more than two-thirds its length. Mouth horizontal, at lower outline of snout, the maxillary nearly reaching vertical from posterior margin of orbit, $2\frac{2}{3}$ in head. Teeth strong, conical, the outer series enlarged in both jaws, a narrow band of villiform teeth behind the outer series. Vomer with a single series. Palatines toothless.

Eyes large, round, closely approximated, their diameter greater than length of snout, twice the width of interorbital space, $3\frac{1}{2}$ in head.

Gill membranes very widely joined, free from isthmus. No hook on inner edge of shoulder girdle.

Head, 5 in length; depth 6 to 7. D. XXV, 13 or 14. A. I, 28. Lat. l. 52.

Dorsal fin beginning on the nape, over front of opercle, its spines slender and flexible, much lower than soft rays. Height of anterior and middle spines about equal, one-third length of head, the posterior spines shortened, about half that length. Height of soft rays one-half head.

First anal ray short and spinous, the succeeding rays articulated, but not branched (like those of dorsal). Interradial membranes of anal fin very deeply incised.

Caudal fin wholly free, rounded, its length nearly equaling that of head.

Pectorals slightly shorter than head, posteriorly pointed, the longest rays below the middle of the fin.

Ventrals comparatively broad, inserted but little in front of pectorals, their bases separated by a space equal to one-third diameter of orbit.

Color in spirits: Brownish above and on sides, becoming blackish on head; under side of head, belly, and a line along each side of anal fin light. Back with traces of about ten black cross-bars, which invade base of dorsal fin and extend onto middle of sides. In one specimen the scales of the interspaces are marked each with a light spot (probably blue in life). Fins all dusky, the caudal variegated with lighter in fine pattern. Ventrals light at base.

Two specimens from the Galapagos Islands, one from Duncan Island, 72 millimeters long, the other from Albemarle Island, 75 millimeters long.

27. *Runula azalea* Jordan and Bollman.

Three specimens from Indefatigable Island.

Teeth fixed, not bristle-like, those in upper jaw slightly compressed, much larger than those in lower, which are close-set and form an almost uniform cutting edge.

D. 40 or 41. A. 25 or 26.

Sides with a median dusky streak becoming most conspicuous posteriorly, terminating in an elongate blackish blotch on tail. Traces can usually be seen of six faint dusky cross-bars, which are continued as black blotches on dorsal and anal, six on the former and four on the latter. On the dorsal fin a smaller intermediate blotch serves to connect each two larger ones, and the fin has in addition a narrow light margin.

Eye, in specimens $1\frac{1}{2}$ inches long, equals interorbital width, is longer than snout, and is contained 3 to $3\frac{1}{4}$ times in head.

28. *Otophidium indefatigabile* Jordan and Bollman.

Four specimens from Station 2797, from 3 to 4 inches long. These differ slightly from the original description.

Head $3\frac{3}{4}$ to 4 in length; depth $5\frac{1}{3}$ to $5\frac{1}{2}$. Maxillary $2\frac{1}{4}$ in head; snout $4\frac{1}{2}$; interorbital width $4\frac{3}{4}$.

Ethmoidal ridge terminating anteriorly in a sharp compressed spine, posteriorly in a much lower point, both being concealed under the skin. Four short gill-rakers on horizontal limb of outer gill-arch. The black blotches on marginal part of dorsal fin correspond in position with the broader cross bars on back.

29. *Citharichthys gilberti* Jenkins and Evermann.

One specimen, Station 2812. This species represents the *Citharichthys spilopterus* of the Atlantic, but differs from it in having fewer gill-rakers and larger eyes. The true *spilopterus* seems not to have been taken in the Pacific, and all references to it should be ranged in the synonymy of *gilberti*. *Citharichthys sumichrasti* Jordan, identical with *gilberti*.

30. *Citharichthys platophrys* sp. nov.

One specimen from Station 2799.

D. 78; A. 62. Lat. 1. 43. Body ovate, the depth 2 in length; head 3. Caudal fin subessile, the free portion of caudal peduncle about half as long as diameter of pupil, its depth one-third length of head.

Mouth very oblique, maxillary $2\frac{1}{2}$ in head, reaching vertical from middle of lower eye. Teeth slender, close set, in a single series in each jaw, those in front of upper jaw largest, but not canine-like.

Eyes large, the lower much in advance of the upper, their horizontal diameter $3\frac{3}{4}$ in head. Interorbital space very wide for a *Citharichthys*, concave, divided by an oblique ridge running backwards from middle of upper orbit. Interorbital width $8\frac{3}{4}$ in head, nearly half as wide as eye. Distance from tip of snout to front of lower eye two-thirds diameter of eye, from tip of snout to upper eye one-third head.

Gill rakers short and very slender, less than diameter of pupil, nine present on horizontal limb of outer arch.

Scales large, those on blind side very weakly ctenoid.

Dorsal beginning behind nostril on blind side of snout, its longest ray $2\frac{1}{2}$ in head.

Pectoral of eyed side long and narrow, 4 in length, containing 11 rays, that of blind side but half its length. Ventrals short. Caudal rounded, $1\frac{2}{5}$ in head.

Color in spirits: Uniform light-brownish (olivaceous in life), without distinctive marks. Fins somewhat dusky. Ventral of eyed side jet-black, that of blind side blackish on distal portion of inner rays.

31. *Engyophrys sancti-laurentii* Jordan and Bollman.

One specimen, Station 2805.

32. *Spheroides fürthi* Steindachner.

Five young specimens from Station 2802.

33. *Canthigaster punctatissimus* Günther.

Two specimens, Station 2797.

34. *Lophiomus setigerus* Wahl.

A single specimen $2\frac{1}{2}$ inches long, from Station 2805.

D. III-III, 9. A. 5. Floor of mouth black posteriorly, but without white spots. Pectorals and ventrals pale on basal half, black distally.

Caudal and anal black, with some white spots. Soft dorsal translucent, with black specks. First dorsal spine with its membranous tip white, the latter provided with two black eyelike spots.

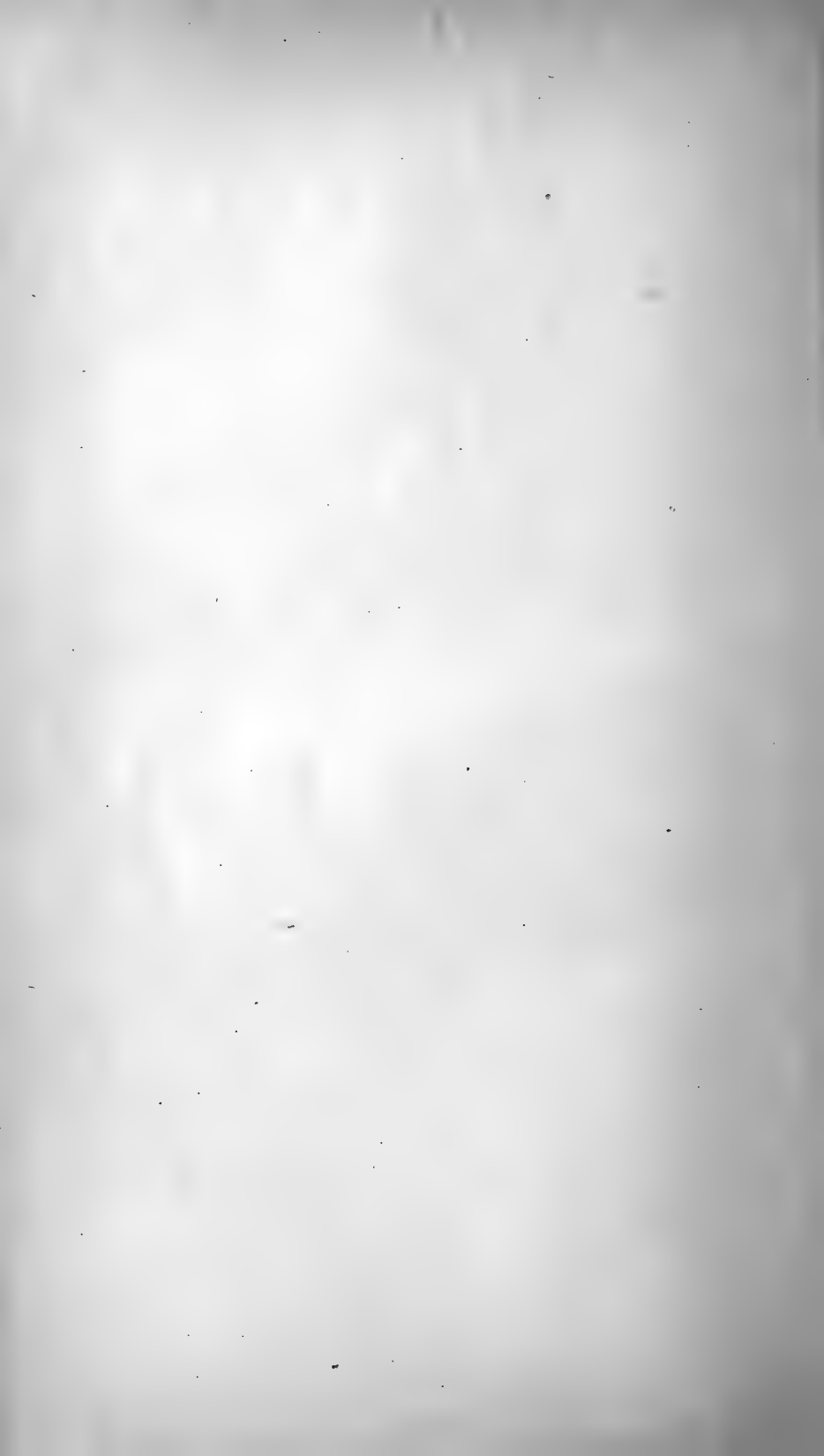
Head above orbits and laterally with numerous spines and prickles. Humeral bone ending in three blunt points. Numerous cirri scattered along sides of head and body.

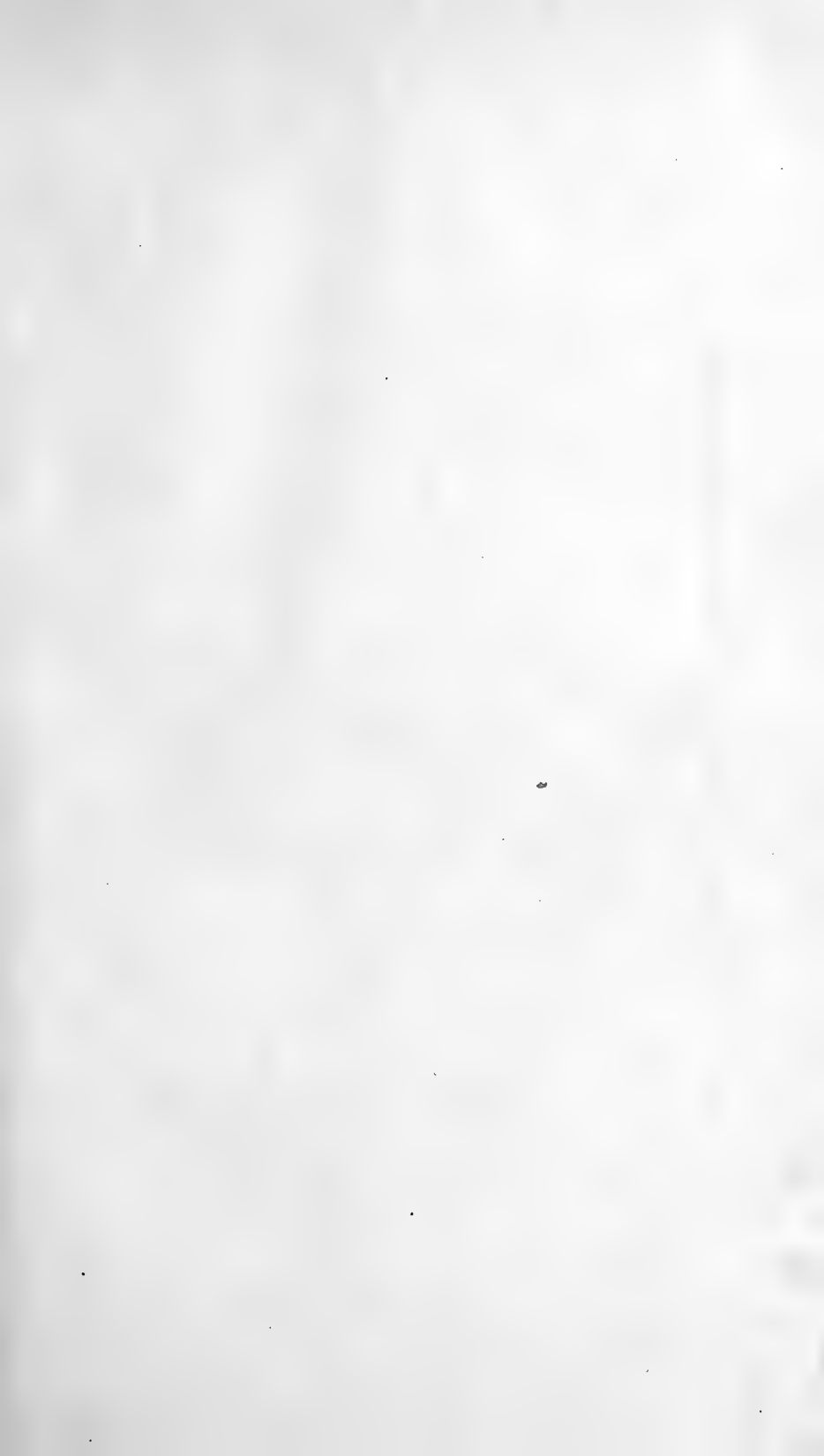
Vertebræ 18.

35. *Malthe elater* Jordan and Gilbert.

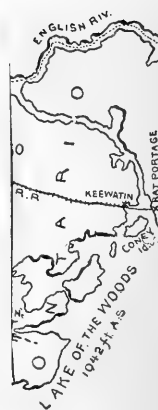
Stations 2794 and 2795.

INDIANA UNIVERSITY, *December 1, 1890.*





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THE BIRDS OF MANITOBA.*

BY

ERNEST E. THOMPSON, OF TORONTO, CANADA,
Associate Member American Ornithologists' Union, etc.

(With plate XXXVIII.)

INTRODUCTION.

BOUNDARIES OF THE PROVINCE OF MANITOBA.

In treating of the birds of this region it seemed most convenient to make the political boundaries of the province, those also of the district included, though this is scarcely defensible from the scientific standpoint. According to the Revised Statutes of Canada, 1886, chapter 47, the boundaries of the province of Manitoba were fixed briefly as follows: On the south, at the forty-ninth parallel of north latitude, which is the international boundary line; on the west by a line along the middle of the road allowance between the twenty-ninth and thirtieth ranges of townships west of the first principal meridian, which line falls between 101° and 102° longitude west of Greenwich; on the north by the middle of the road allowance of the twelfth base line, which is north latitude $52^{\circ} 50'$; on the east by the meridian of the northwest angle of the Lake of the Woods which, according to Professor Hind is $95^{\circ} 50'$ longitude west of Greenwich.

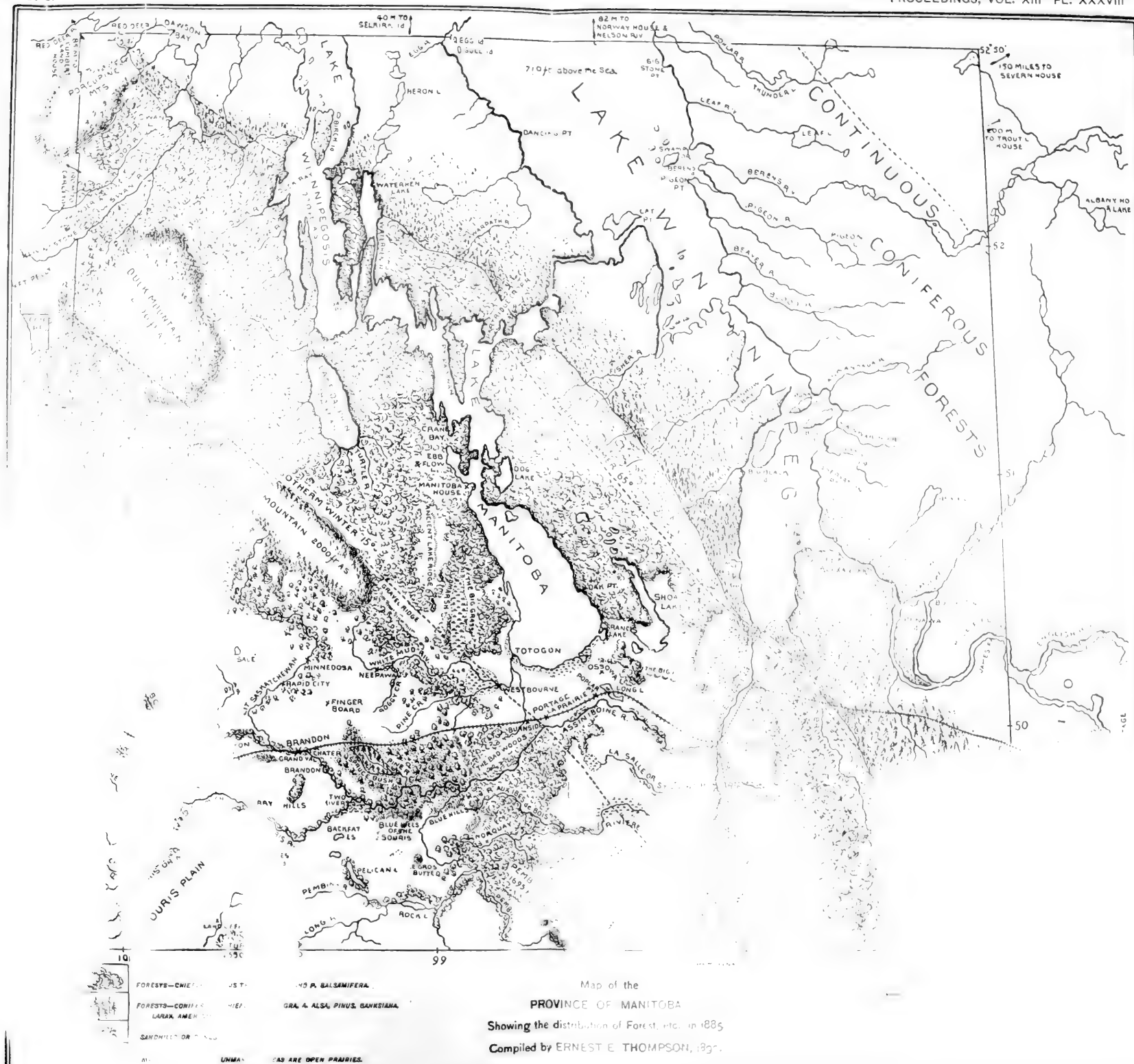
In preparing my own map full use has been made of the maps pub-

*In offering the following observations in their present shape, *i. e.*, as they were made on the spot, without material condensation or generalization, I believe that I have taken not merely the best but the only right course under the circumstances. My original plan, as may be seen by the "notes" throughout, was to prepare something after a very old-fashioned model, but widening experience caused a considerable change of view. No one regrets more than myself their imperfectness, and, in some cases which I have pointed out, their unreliability. If I could see my way clear to revisit Manitoba in the near future I would gladly defer publication in the hope that I might first remove numerous doubts and fill many unfortunate blanks, but under existing circumstances there seems to be no course but to carefully revise my old journal and let it go forth for judgment.

My own observations are supplemented by those of numerous observers in various parts of the province, and I have also endeavored to include all available records relating to distribution and all valuable published matter relating to the ornithology of Manitoba that has not appeared in a special work on birds. This excludes only Dr. Coues's field notes * * * forty-ninth parallel, which, however, is constantly cited.

In all the records I have given the exact words of the writer are quoted.

Altogether I spent about 3 years in the province, my first visit extending from March 28, 1882, to November 16, 1883; my second from April 25, 1884, to January 27, 1885; my third from October 25, 1886, to January 12, 1887, broken only by occasional



lished by Professor Hind in 1860, by the Dominion Government in 1874, and by the Canadian Pacific Railway Company at various times between 1880 and 1890, also those drawn by Mr. Shawe for Phillip's Imperial Atlas, and those issued by the Tenth Census Report of the United States. I have also supplemented these by information gained in my own travels, as well as that supplied me by Messrs. Tyrrell, Nash, Macoun, Christy, and other observers.

PHYSICAL FEATURES OF THE PROVINCE.

The general features of the country have been ably and concisely described by Dr. Dawson in the report of the boundary commission (1875), as follows:

The first or lowest prairie level, is that of which the southern part lies along the Red River, and which, northward, embraces Lake Winnipeg and associated lakes, and the flat land surrounding them. A great part of its eastern border is continuous with that of Lake Winnipeg, and formed by the rocky front of the Laurentian; but east of the Red River it is bounded by the high lying drift terraces surrounding the Lake of the Woods, and forming a part of the drift plateau of northern Minnesota. To the west it is limited by the more or less abrupt edge of the second prairie level, forming an escarpment, which, though very regular in some places, has been broken through by the broad valleys of the Assiniboine and other rivers. The escarpment, where it crosses the line, is known as Pembina Mountain, and is continued northward by the Riding, Duck, Porcupine, and Basquia Hills. The average height above the sea of this lowest level of the interior conti-

expeditions outside of our boundaries. Carberry was my headquarters, and except where otherwise stated all observations were made at that place.

My companions, whose names appear, were Mr. Wm. G. A. Brodie, whose untimely death by drowning in the Assiniboine, May, 1883, robbed Canada of one of her most promising young naturalists; my brother, Dr. A. S. Thompson, with whom I lived, and Mr. Miller Christy. The last was with me during the latter part of the summer of 1883 and again for a few days in the July of 1884. He was the first ornithologist of experience that I had ever met, and I have to thank him for correcting in me many wrong methods of study that naturally were born of my isolation.

My thanks are due to Dr. J. A. Allen, of the American Museum of Natural History; Prof. Robert Ridgway, of the Smithsonian Institution; and Dr. C. Hart Merriam, ornithologist to the U. S. Department of Agriculture, for the identification of numerous specimens, and other assistance, and especially to the last for placing at my disposal the manuscripts of Miss Yoemans, Messrs. Calcutt, Criddle, Nash, Plunkett, Small, and Wagner; to Prof. John Macoun, of the Canadian Geological Survey; Messrs. Christy, Nash, Hine, Hunter, and Guernsey, for numerous manuscripts, notes, and much valuable assistance; to Dr. R. Bell and Mr. James M. Macoun, both of the Canadian Geological Survey; Dr. William Brodie, of Toronto; Dr. Charles Carpmael, of the Canada Meteorological Department, and Mr. Ernest D. Wentle, of Montreal, for help in various ways; and to the Hudson's Bay Company for access to the Hutchins manuscripts. Indispensable assistance in preparing the manuscript has been rendered also by my father, Mr. Joseph L. Thompson, and my cousin, Miss M. A. Burfield.

The measurements throughout are in English inches.

ERNEST E. THOMPSON,

86 Howard street, Toronto, Ontario.

JULY, 1890.

mental region is about 800 feet; the lowest part being that surrounding the Winnipeg group of lakes, which have an elevation of about 700 feet. From this it slopes up southward, and attains its greatest elevation—960 feet—at its termination far south in Minnesota. The edges of this prairie level are also, notwithstanding its apparent horizontality, considerably more elevated than its central line, which is followed by the Red River. Its width on the forty-ninth parallel is only 52 miles; its area, north of that line, may be estimated at 55,600 square miles, of which the great system of lakes in its northern part—including Lakes Winnipeg, Manitoba, Winnipegosis, Cedar, and St. Martin's—occupy 13,900 miles. A great part of this prairie level is wooded more or less densely, and much of the low-lying land near the great lakes appears to be swampy and liable to flood. The southern part, extending from the boundary line nearly to the south end of Lake Winnipeg, includes the prairie of the Red River valley, with an area of about 6,900 square miles; one of the most fertile regions, and, at the same time, the most accessible portion of the Northwest.

The superficial deposits of this stage are chiefly those of a great lake which occupied its area after the glacial submergence. This part of the interior of the continent being the last to emerge from the Arctic waters and having been covered for a long time afterward by a sea of fresh water, held back either by drift deposits or by rocky barriers, which have subsequently been cut through, and which must have united all the lakes now found in the region into one sheet of water, which extended with narrower dimensions about 200 miles south of the boundary line.

The Red and the Assiniboine Rivers and their tributaries have not yet cut very deeply into its alluvial deposits and its surface is level and little furrowed by denudation.

The second steppe of the plains is bounded to the east, as already indicated, and to the west by the Missouri coteau, or edge of the third prairie level. It has a width at the forty-ninth parallel of, probably, 200 miles, though it can not there be strictly defined. Its total area is about 105,000 square miles, and includes the whole eastern portion of the great plains, properly so called, with an approximate area of 71,300 square miles. These occupy its southern and western portions, and are continuous westward with those of the third prairie steppe. To the south, the boundaries of this region appear to become more indefinite, and in the southern part of Dakota, the three primary levels of the country, so well marked north of the line, are probably scarcely separable. The rivers have acted on this region for a much longer time than on the last-mentioned, and are now found flowing with uniform currents in wide ditch-like valleys, excavated in the soft material of the plains, and often depressed from 100 to 300 feet below the general surface. In these the comparatively insignificant streams wander from side to side, in tortuous channels, which they only leave in time of flood. The surface of this prairie steppe is also more diversified than the last, being broken into gentle swells and undulations, partly, no doubt, by the action of denudation, and partly, also, as will appear, from the original unequal deposition, by currents and ice, of the drift material which here constitutes the superficial formation. The average altitude of this region may be taken at 1,600 feet, and the character of its soil and its adaptability for agriculture differ much in its different portions.

The third or highest prairie steppe may be said to have a general normal altitude of about 3,000 feet, though its eastern edge is sometimes little over 2,000 feet and it attains an elevation of 4,200 feet at the foot of the Rocky Mountains.

Obviously none of the third steppe would fall within our limits were it not for a curious exception that is presented by the Turtle Mountain, which, though belonging to the third steppe, stands like an island upon the open sea of the second. Of this Dr. Dawson says:

Turtle Mountain, an outline of the third prairie steppe, is a broken, hilly, wooded region, with an area of perhaps about 20 miles square (400 square miles), and slopes

gradually upward from the plain around it, above which it is elevated, at its highest points, about 500 feet. It appears to be the culmination westward of the hilly drift region previously described, and forms a prominent object when viewed across the eastern prairie, from the contrasting somber tint of the foliage of its woods. From the west it can be seen from a distance of 45 miles, and when thus viewed has really much the general outline of a turtle shell. It is bisected by the forty-ninth parallel.

According to Mr. Tyrrell's map, the altitudes of the large lakes, etc., to the west have hitherto been given fully 60 feet too low; as, however, I am without corrected figures for other points whose altitudes are given, I have elected to let older computations stand, and they may be taken as relatively correct.

"*The sandhills*," so often referred to, are certain low sand dunes that cover a considerable extent of country in the vicinity of Carberry. They are in most cases low undulations rather than hills, are sparsely covered with grass and dotted over with beautiful clumps of trees, while the hollows and flats are diversified with lakelets that swarm with waterfowl and lower forms of life. The general appearance of the sandhills country is quite park-like, and notwithstanding its unattractive name this region as a whole is the most pleasing to the eye and fuller of interest and varied pleasure for the naturalist than any other that I have seen in Manitoba. "*The Big Plain*" is an unusually level prairie extending from Carberry northward about 30 miles.

"*The White Horse Plains*" form a similar region between Shoal Lake and the Assiniboine.

"*The Souris Plains*" include the southwestern corner of Manitoba that is drained by the Souris River. This is a remarkably level region, entirely cleared of trees excepting in the river gorges, and diversified by numerous marshes and alkaline flats.

"*Bluff*" is, in Manitoban parlance, the name applied to any isolated grove of trees on the prairie. The term is never used here, as in the Western States, to mean an abrupt bank or escarpment.

Distribution of forest and prairie.—All that portion of Manitoba that lies to the eastward of the lowest prairie steppe, as above defined, is a rocky Laurentian region full of rivers and lakes of fresh water, and thickly wooded, being within the limits of the great coniferous forest. A wide strip of the flat country lying to the westward of Lake Winnipeg, likewise the elevated plateaus of Riding, Duck, and Porcupine Mountains, are also to be classed as parts of the northern forest. There is good reason for believing that at one time, not very remote, the rest of Manitoba was covered with a forest of aspens or poplars (*Populus tremuloides*), slightly varied by oak (*Quercus macrocarpa*), spruce (*Abies alba et nigra*), birch (*Betula papyracea*), etc., which has been removed by fire, so that trees are now found growing only in such places as are protected from the fires by streams, lakes, marshes, or sandy tracts where so little grass grows that the fire can not travel; consequently, notwithstanding the prevalent idea of Manitoba as a purely prairie region, there is more or less timber in nearly all parts of the country as indicated on

the map. Thus I have endeavored to make a record of the distribution of forests in 1885, for evidently no natural feature is more likely to change in a few years than the extent of woodlands. The line limiting the coniferous forest on the south is copied from the forestry map issued with the Tenth Census report of the United States. It is suspiciously straight and even, but is doubtless correct when understood merely as a broad generalization. I regret that I am without the material necessary to define this limit more accurately. To the southward of Carberry is a small isolated forest of spruce that is known as the Spruce Bush or the Carberry Swamp, by which names it is herein referred to.

Water.—The province is plentifully, almost too plentifully, supplied with water. In addition to the numerous extensive lakes indicated on the map are thousands more of smaller extent, while the region of the Red River Valley in particular is diversified by vast stretches of marsh and lagoon. The various lakes are of two kinds, first the sweet water or live water lakes, fed and drained by living streams, teeming with fish and varying in size from that of a mere pond to that of Lake Winnipeg; second, the alkaline lakes, which are mere drainage basins and depend solely on evaporation for the removal of their accumulated waters.

They owe their alkaline impregnation not to anything of the nature of salt-bearing strata, but to the continual influx and evaporation of surface water very slightly impregnated with alkali through running over the prairies strewn with the ashes of the annual fires. These "dead waters" never, so far as I know, contain fish, but they are usually swarming with a species of amblystoma and numerous kinds of leeches and aquatic insects. These lakes abound on the prairies and in the sand hills, but are usually of very small extent. They have, I believe, several peculiar species of sedge, and are especially frequented by certain kinds of birds that seem to avoid the fresher waters, *e. g.*, Baird's Sparrow, Avocet, etc.

Salt springs, etc.—The following extract from Professor Macoun's well-known work on "Manitoba and the great Northwest, 1883," will prove an interesting item of physiography:

Lying farther south [than the Silurian], and possibly underlying the greater part of the western side of the Manitoba Plain, is the Devonian Series. These rocks are known to be largely developed on both sides of Lakes Manitoba and Winnipegosis. Numerous salt springs are found in connection with them, and during the last summer the writer saw salt springs and brooks of strong brine flowing from them in various localities at the head of Lake Winnipegosis. The subjoined list of salt springs known to occur on Lakes Manitoba and Winnipegosis may tend to excite interest in these extensive deposits:

1. Crane River, Lake Manitoba.
2. Waterhen River, Dickson's Landing.
3. Salt Point, east side of Lake Winnipegosis.
4. Salt Springs, Winnipegosis.
5. Pine River, Winnipegosis.
6. Rivers near Duck Bay.

7. Turtle River, Lake Dauphin.
8. Swan or Shoal, two localities.
9. Salt River, flowing into Dawson's Bay.

10. Numerous salt springs and bare, saturated tracts of many acres in extent on Red Deer River, which flows into the head of Dawson's Bay, Lake Winnipegosis. For 10 miles up this river salt springs are quite frequent, and excellent salt was collected in three places, where it formed a crust on the surface of the ground. Some springs were examined where a respectable rivulet of strong brine issued from them, as clear as crystal, and evidently quite pure. All the springs and marshes seen were bordered with seaside plants, and one of them, which has never been found from the seacoast before in America, was found in abundance. The plant referred to is Sea-Side Plantain (*Plantago maritima*).

The following extract from Professor Hind's report (1858) shows that this line of saliferous strata goes right across our province:

Near and west of Stony Mountain many small barren areas occur, covered with saline efflorescence; they may be traced to the Assiniboine, and beyond that river in a direction nearly due south to La Riviere Sale and the forty-ninth parallel. These saline deposits are important, as they in all probability serve, as will be shown hereafter, to denote the presence of salt-bearing rocks beneath them, similar to those from which the salt springs of Swan River, Manitoba Lake, and La Rivière Sale issue.

Meteorology.—I have not been able to obtain the material necessary for a general chapter on the meteorology of Manitoba, and must content myself with a few statistics taken from Professor Bryce's article on Canada in the *Encyclopædia Britannica*.

The mean annual temperature for 11 years, (1871-1881, inclusive), taken near Winnipeg, was 33.06° , the maximum 95.34° , the minimum -40.51° ; the mean amount of rain, 16.977 inches; the mean amount of snow, 52.72 inches; the mean total precipitation of rain and snow, 23.304 inches; the mean height of the barometer, 29.153. The mean average temperature for the years 1880 and 1881 was as follows: January, $2^{\circ}.9$; February, 3° ; March, 9° ; April, $30^{\circ}.2$; May, $51^{\circ}.2$; June, $63^{\circ}.6$; July, $65^{\circ}.9$; August, $64^{\circ}.8$; September, $51^{\circ}.3$; October, 40° ; November, $14^{\circ}.6$; December, $0^{\circ}.6$; the year, $32^{\circ}.6$.

The isotherms indicated on the map were taken from the map prepared to Professor Macoun's work.

Topography.—The topography of Manitoba is somewhat perplexing through the duplication of names. Many, such as Pelican Lake, Swan Lake, Shoal Lake, Rat Creek, etc., appear several times over. None of these duplications have been entered on the map, with the exceptions of Shoal Lake and Boggy Creek. In the first case I have added the word "West" to the name of the lake which is of secondary importance and probably of later naming. In the second the three creeks are distinguished as Boggy Creek, Big Boggy Creek, and Little Boggy Creek. Every name referred to in the notes, with exceptions noted herein later, will be found on the map, with many additional ones that are of importance. Frequent allusion is made to Professor Macoun's journeys and the region observed by him in making them. These expedi-

tions were as follows: 1879, from Winnipeg to Fort Ellice by water and thence up the Qu'Appelle River; 1880, from Winnipeg to Grand Valley, now Brandon, by water and thence overland to Moose Mountain; 1881, from Winnipeg to Portage la Prairie by rail, thence overland to Totogon down Lake Manitoba by boat into Waterhen River and into Waterhen Lake, and back by the western channel into Lake Winnipegosis, and along the western shore of this lake into the larger bays, up Swan River to Swan Lake, then back to Winnipegosis and up Red Deer River to Red Deer Lake, up its southern affluent across country to Livingstone and down the Assiniboine to the railroad at Brandon.

Humphrey's or McGee's Lake, Hope's Lake, Smith's Lake, and Markle's Lake are small drainage lakes near Carberry. White Horse Hill, Kennedy's Plain, and De Winton Slough are also close to Carberry. These have been omitted from the map, as they are too small for the scale on which it is drawn.

The following places outside of the province have been mentioned to extend or explain the distribution of certain species:

Carleton House: On the north branch of the Saskatchewan.

Cumberland House: On the Lower Saskatchewan.

Fort Pelly: On Assiniboine River, 10 miles west of Duck Mountain.

Fort Qu'Appelle: On Qu'Appelle River, 100 miles up from its junction with the Assiniboine.

Moose Mountain: Assiniboia, 35 miles westward of Manitoba, about latitude $49^{\circ} 40'$ north.

Nelson River: The outlet of Lake Winnipeg, situated at its north end.

Norway House: North end of Lake Winnipeg.

Rat Portage: On the Lake of the Woods, where it is touched by the Canadian Pacific Railway.

Red Deer River: Flowing into Red Deer Lake, at the northwest corner of the province.

Severn House: On Severn Lake, at $54^{\circ} 5'$ north latitude and $92^{\circ} 30'$ west longitude, about 150 miles northeastward of the province.

Selkirk: Lake Winnipeg, about 40 miles north of the northern boundary.

Touchwood Hills: 30 miles north-northwest of Fort Qu'Appelle.

Trout Lake House: On Trout Lake, at $53^{\circ} 50'$ north latitude and 91° west longitude, about 200 miles northeast by east of the province.

White Sand River: A tributary of the Upper Assiniboine, near the northwest corner of the province.

1. *Æchmophorus occidentalis*. Western Grebe.

Tolerably common summer resident in Red River Valley, chiefly towards the northward, as follows: Quite common at Shoal Lake, near Lake Manitoba, and less so at Redburn (Hine). A rare summer resident along Red River (Hunter). Breeding in vast numbers at Shoal

Lake and Lake Manitoba, not elsewhere (D. Gunn). "Clark's Grebe," Shoal Lake (Brewer). Breeding on Lake Manitoba and very abundantly in the marshes of Waterhen River, between it and Lake Winnipegosis. I took great numbers of eggs on Waterhen River and the south end of Waterhen Lake (Macoun).

I did not meet with this bird in any part of western or southern Manitoba, but at Winnipeg I was shown several specimens taken near Redburn, where it is somewhat common, and others from Shoal Lake, where it is quite plentiful. These facts, together with the following statement by Professor Macoun, are the more interesting when we consider that for a long time this grebe has been considered a bird of the Pacific region.

In his work on the Northwest, Professor Macoun writes:

On Waterhen River and Lake the Western and Red-necked Grebes breed in great numbers. Their nests are built on the old sedges and rise and fall with the water. Here the Indians collect large numbers of eggs in the proper season, and one old fellow, last season, astonished me by the remark that he could have fresh eggs all summer. On inquiry I learned that he went regularly to the same nests and never took all the eggs so that he kept the poor bird laying all summer.

Mr. D. Gunn makes the following remarks on this species at the lake in question:

The annual resort of the *Podiceps occidentalis* to Shoal Lake is, as has been observed, "remarkable." From the most reliable information that I could obtain from the Indians at this place it has never been seen on the Red River nor on Lake Winnipeg, and I have never heard of its having been seen anywhere in what is commonly known as Rupert's Land, except at Shoal Lake and Manitoba, and I may add that it is also remarkable that there are very few grebes to be found in any other of the bays connected with the lake, although all these bays abound in reeds and rushes. Possibly these birds prefer the bay on the north point on account of its being sheltered from the wind, and probably a greater facility for obtaining food in that locality may influence them in the choice they make. I am inclined to think that the large grebes feed on aquatic plants; I opened several of their gizzards and found nothing in them but grass. The Western Grebes, when seen in groups on the smooth, unruffled waters of the lake, make a splendid appearance, sometimes raising themselves out of the water, and flapping their wings, their white breasts glistening in the sun like silver. They are not timorous, but when alarmed they sink their bodies in the water, and if the object of their fear still presents itself they plunge head foremost and dive and continue a long time under the water, often disappointing the expectations of their pursuers by reappearing in a different direction from that anticipated. They make their nests among the reeds on the bent bulrushes of the last season; the frame or outer work is of reeds and lined with grass from the bottom and reed leaves. The nest is nearly on a level with the surrounding water and may be said to float at its "moorings," held there by the reeds. We found hundreds of these nests containing two, three, and four eggs each; I believe six to be the highest number we found in any one. We took thirteen grebes, of which the males were larger than the females; the largest male measured, before skinning, $27\frac{1}{2}$ by $36\frac{1}{2}$ inches and 14 inches round the body at the head of the wings. The largest female measured $24\frac{1}{2}$ by $32\frac{1}{2}$ inches. We shot not a few of them in the act of leaving their nests, and most of them on being skinned proved to be males, which fact inclines me to believe that the male bird takes his turn in sitting on the eggs.

2. *Colymbus holboëllii*. Holboëll's Grebe. Red-necked Grebe.

Summer resident chiefly of the shallow, fish-frequented lakes to the northward. Winnipeg: Summer resident; very rare; only 4 specimens taken up to 1885 (Hine). Breeding in considerable numbers at Shoal Lake; comparatively rare in Red River region (D. Gunn). Specimen from Red River settlement in Smithsonian Institution (Blakiston). Breeds abundantly in the marshes of Waterhen River and south end of Waterhen Lake, where I took great numbers of its eggs (Macoun). Duck Mountain; breeding (Thompson).

On June 18, 1884, while hunting at Duck Mountain, above Boggy Creek, with my brother, we came to a small lake and parted to go around it in different directions. When we met, he showed me a nest which he had found among the reeds in 2 feet of water. It was a mere floating mass of wet rushes, and had been moored by a few growing rushes whose tops had been incorporated with the structure. It contained 3 eggs, which the bird was hastily covering with more rushes when he first saw her. From his description, and from what I could see at 200 yards distance, it was apparently an adult Red-necked Grebe, but the bird was too shy to admit of the identification being completed in the only perfectly reliable way.

As there are no fish in these isolated mountain lakes, these birds probably live largely on amblystomæ, crawfish, and insects.

3. *Colymbus auritus*. Horned Grebe.

Abundant summer resident of general distribution; very abundant; breeding at Pembina and the base of the Turtle Mountain (Coues). Lake Winnipeg (Murray). Red River (Kennicott). Common summer resident in Red River Valley (Hunter). Common about Winnipeg (Hine). Very common on Red River, and breed in the marshes near Shoal Lake (Gunn). Portage la Prairie; common summer resident (Nash). Observed in the ponds from Turtle Mountain to Brandon, in May, 1882; commonly breeding in all the ponds about the Big Plain, being the most abundant Grebe of the region; common also from Carberry to Rapid City and thence west to Fort Ellice, and in the whole region on both sides of the Assiniboine, northward to Duck Mountain (Thompson). Abundant on Waterhen River; breeding; they give the name to the river; the common Grebe of the prairie ponds (Macoun). Shell River; 1885, first seen, two on May 3; afterwards seen every day; it is common all summer and breeds here (Calcutt). Trout Lake (Murray).

On July 20, 1883, in a lake near "The Gore," shot a Horned Grebe. It had saved itself once or twice by diving at the puff of smoke, so I sought the cover of the bushes and fired through an opening, and as no smoke was visible I got the bird. It was an adult male; length, 14 inches, extent 24 inches; moulting; iris blood red, with an inner circle of white around it; basal region and part of lower mandible adjoining

covered with bare red skin ; in examining the eye, I squeezed out a leech, that was sometimes like a No. 4 shot or again like a small needle.

On June 3, 1884, while traveling on the Birtle trail from Rapid City I noticed a pair of Horned Grebes in a small pond. I fired and disabled one. On wading in I found it was shot in the eye and was perfectly blind, though otherwise unhurt. Having heard sundry curious theories about the way in which these birds move their feet, I kept it alive for observation. When ordinarily swimming the feet strike out alternately, and the progression is steady, but sometimes both feet struck together, and then the movement was by great bounds and was evidently much better calculated to force the bird over an expanse of very weedy water or through any tangle of weeds or rushes in which it might have found itself. When lifted out of the water the feet worked so fast as to be lost to the eye in a mere haze of many shadowy feet with one attachment. When placed on the ground it was perfectly helpless. At nights I laid it by my side on the grass, and each morning I found it still in the same place. During the day I carried it in a bucket swung under the wagon. It often tried to leap out of this, but never succeeded. On the second day of its captivity it laid an egg, which was like a duck's egg with a heavy coat of whitewash. On the third day, after the wagon had crossed some rough ground, which had set the pail violently swinging, I found the grebe was gone. All the specimens of *cornutus* that I have examined have the eye all blood-red except a thin ring of white which immediately surrounds the pupil.

On August 21, 1884, shot a Horned (?) Grebe in the lake southwest of here. Several young ones were seen. No doubt the species breeds there as in all the small drainage ponds in this region, although they are totally devoid of fish. The only animal food available for the grebes in there is *amblystomæ*, frogs, leeches, and insects.

Dishishet Seekeep or Little Diver. This bird differs but little from Mr. Pennant's small grebe. It weighs 5½ ounces, harbors in our fresh waters, where it builds a floating nest of grass, laying from three to five eggs of a white color; the heat of the bird causing a fermentation in the grass, which is a foot thick, makes a kind of hot-bed, for (please to observe) the water penetrates through the grass to the eggs. (Hutchins's Observations on Hudson Bay. MSS. 1782.)

4. *Colymbus nigricollis californicus*. American Eared Grebe.

Common summer resident, breeding abundantly on Turtle Mountain and at points along Mouse River, near the boundary (Coues). Common summer resident in Red River Valley (Hunter). Winnipeg: Summer resident tolerably common (Hine). Breeding in great numbers at Shoal Lake and on Red River (D. Gunn). Quite common on pools in prairie regions (Macoun). Very numerous in this bay (Grebe Bay, Shoal Lake). They make their nests on the bulrushes, composed of the same material. We found as many as six eggs in some nests, but in the greater number of nests only four. They are very shy and

expert divers, are very common on the Red River, and breed in the marshes near the lake (D. Gunn).

5. *Podilymbus podiceps*. Pied-billed Grebe. Dabchick.

Common summer resident in all waters, living and dead; breeding at Pembina and on ponds at the base of the Turtle Mountain (Cones). Winnipeg: Summer resident; tolerably common (Hine). Red River Valley: Summer resident; common; breeds at Shoal Lake (Hunter). Portage la Prairie; very abundant; summer resident on every lake, slough, or pond large enough to give them sufficient "water privilege;" arriving as soon as the ice is out and departing when their haunts are frozen over. First seen, May 6, 1884, April 24, 1885, April 19, 1886 (Nash). Frequently observed in the ponds from Turtle Mountain to Brandon; in May, 1882, common and breeding in the ponds about Carberry, also at Rapid City (Thompson). In immense numbers (killed four at a shot) in August and early part of September on the headwaters and marshes of Swan River; abundant on all pools south of Touchwood Hills; apparently more northern than the preceding (Macoun). Shell River, May 4 (Calcutt).

On June 30, 1882, at Rapid City, found a Pied-billed Grebe lying dead on the road. This species seems to be very abundant throughout the country from here to Carberry, and from Carberry to Turtle Mountain, for the peculiar call note "*pr-r-r-r-r tow tow tow tow*" (that I ascribe to this species) is heard in nearly every marsh throughout the region indicated.

On August 12, 1883, I came on a pair of Pied-billed Grebes in McGee's Lake, Carberry. Instead of diving they commenced flapping over the surface and excited my curiosity so that I shot them both. They were both Dabchicks, and I found they would not dive because the water was very weedy at that place. Their gizzards were full of water insects and feathers. These last are commonly found in gizzards of Grebes. I know of no explanation of this fact, unless it be to muffle the movements of newly swallowed living prey.

On September 13, 1884, at Portage la Prairie, found Dabchicks here yet. They seem more numerous here than at Carberry.

6. *Urinator imber*. Loon. Big Helldiver.

Summer resident on the larger fish frequented lakes. Summer resident; abundant, and breeding on Lake Winnipeg and the larger rivers (Hine). Swampy Island: 1885, first seen, four, on May 30; next seen May 31; rare around this island; not breeding here; common at northern end of lake in fall; last seen September 27; in 1886, first seen, twenty, on May 14 (Plunkett). Oak Point: 1884, arrived May 1 (Small). Portage la Prairie: Tolerably common on Lake Manitoba throughout the summer, arriving with the first general thaw in spring and retiring when driven out by the frost (Nash). Common only on the northern

lakes in the forest country; saw some on Red Deer Lake; never more than a pair together; never saw it in the prairie region (Macoun). Riding Mountain: June, 1884 (Thompson). Shell River: 1885, first seen, a pair on May 4; afterwards, seen every day; is common all summer and breeds here (Calcutt). Qu Appelle: Common summer resident, breeds; arrives April 28 (Guernsey). Severn House (Murray).

Athine moqua, or Great Northern Diver. This elegant bird is seldom seen on the seacoasts, but resides among the lakes above 100 miles to the southward of York Fort, for which reason they are called the inland loons. (Hutchins's MSS. Observations on Hudson's Bay, 1782.)

7. *Urinator arcticus*. Black-throated Loon.

Recorded by Andrew Murray, from Severn House, and therefore probably Manitoban.

8. *Urinator lumme*. Red-throated Loon.

Winnipeg: Rare (Hine). Norway House (Bell).

Assee moqua, or Red-throated Diver. * * * It appears in these parts when the rivers are open and retires about the end of September. Its note is harsh and disagreeable, like squalling. They make no nest, only lining the place with a little down from the breast, on which they deposit their eggs towards the end of June; they are of a stone color and only two in number. The young ones fly before the end of August. They live chiefly on fish and are excellent divers, and so very troublesome to the nets that I have this summer taken out fourteen of them that were caught in one tide at a single net. (Hutchins's Observations on Hudson's Bay, 1782.)

9. *Cephus mandtii*. Mandt's Guillemot.

Severn House (Murray). This species may be named as probably Manitoban on the above grounds.

10. *Larus argentatus smithsonianus*. American Herring Gull.

Summer resident about the larger bodies of water; breeding in great numbers at Lake Winnipeg (D. Gunn). Specimen from Nelson River, in Smithsonian Institution (Blakiston). Oak Point: 1884, arrived April 21; 1885, first seen, two, on April 18; next seen, two, on 19th; is common, and breeds here (Small). Breeding in all the large prairie lakes (Macoun). Portage la Prairie: Occurs during the spring and autumn migrations (Nash). Severn House (Murray).

The island on which we were detained by a storm, is one of the Gull-egg group, which, with a point of land protruding from the main land, forms a pretty good harbor on the south side of the neck of the great promontory. The Indians were nearly destitute of provisions and followed us to the island, where they fortunately got a plentiful supply of eggs and young gulls; but having little ammunition, they brought down only a few old ones, although they hovered in countless numbers over the island, screaming at the wholesale destruction of their young brood. (Hurd, August 24, 1858.)

11. *Larus delawarensis*. Ring-billed Gull.

Summer resident, near Mouse River, on the boundary, in September (Coues). Winnipeg: Summer resident, tolerably common, and at Lake

Winnipeg (Hine). North, in summer, to Lake Winnipeg (Brewer). Breeding in all the lakes of any size (Macoun).

12. *Larus franklini*. Franklin's Gull. Rosy Gull.

Summer resident about the large lakes. Winnipeg: Summer resident; abundant; breeding in the prairie marshes of the neighborhood (Hine). Swamp Island: 1885, first seen, two, on May 28; next seen, May 29, after which it was common; it breeds here, and is an abundant summer resident; in fall, last seen September 25; 1886, first seen, six, on May 18; bulk arrived May 20 (Plunkett). Breeding at Selkirk Settlement, Red River Settlement, and in numbers at Swan Creek, Oak Point, Lake Manitoba (D. Gunn). Shoal Lake: May 15, 1887; common (Christy). Portage la Prairie: Common in spring migration; in 1884, first seen April 21 (Nash). Breeding abundantly on Lake Winnipegosis, 1881 (Macoun). Carberry: A common spring migrant (Thompson). Turtle Mountain: Young (Coues). Shell River: 1885, "Black-Headed Gull," first seen, two, on April 24; next seen, nine, on May 2; a transient visitant passing north and not remaining any time or breeding (Calcutt).

13. *Larus philadelphia*. Bonaparte's Gull.

Summer resident about the larger lakes. Winnipeg: Tolerably common here in fall (Hine). A few breeding in the marsh of Swan Creek, not far from Shoal Lake (D. Gunn). Breeding in great abundance on all the large lakes of the prairie region, chiefly west of Manitoba (Macoun). One in Smithsonian Institution from Nelson River (Blakiston). Portage la Prairie: Abundant during the spring migration, and some probably stay to breed, as I have occasionally seen single birds about the prairie sloughs during the summer (Nash). Severn House; fortunately several specimens of this gull have been received; it is rare in collections, but would appear not to be so in Hudson's Bay (Murray).

14. *Sterna forsteri*. Forster's Tern.

Summer resident about the large lakes; breeding in large numbers on the borders of Lake Winnipeg in the latter part of May; at Shoal Lake, saw Forster's terns in considerable numbers; they nest among the reeds; Selkirk Settlement (D. Gunn). Shoal Lake, May 15; common (Christy). Breeding abundantly in Lake Manitoba, Waterhen River, and Lake Winnipegosis (Macoun). Portage la Prairie: Abundant during the spring and autumn migrations; probably breeds, as I have seen a few in summer (Nash).

15. *Sterna hirundo*. Common Tern. Sea Swallow.

Common summer resident on the large lakes; feeding largely on small fish. Winnipeg: Summer resident; tolerably common (Hine). One

taken on Lake Winnipeg, June 16 (Humicalt). Breeding on Lake Manitoba, Waterhen River, and Lake Winnipegosis (Macoun). Portage la Prairie: Tolerably common during spring and autumn migrations; a few remain about Lake Manitoba during the summer (Nash).

There are numbers of terns breeding annually at Shoal Lake; some of them on small, gravelly islands. These form their nests by removing the gravel, making hollows in which they lay their eggs; others of them take up their abode among the reeds and rushes. Here, with great industry and ingenuity, they make their nests of reeds and grass, fixing them in their place to keep them from floating away. When in Lake Winnipeg, in 1862, I observed that the terns which occupied sandy and gravelly islands made their nests as those do on the gravelly islands in Shoal Lake; and the terns found on the rocky island on the east side of the lake chose for their nests depressions and clefts in the surface of the rocks. These they line carefully with moss; three or four eggs being laid in each nest; thus exhibiting a remarkable example of instinct, which teaches these little creatures that their eggs laid in soft sand and in loose gravel are safe without any lining to protect them, but that when laid in hollows and clefts of rocks, lining to protect their eggs and young from injury by these hard, and at night cold, materials would be indispensable. (D. Gunn.)

16. *Hydrochelidon nigra surinamensis*. Black Tern, or Marsh Tern.

Abundant summer resident; chiefly about the prairie ponds, dead waters; breeding at Pembina; Mouse River at the boundary (Cones). Winnipeg: Summer resident; abundant (Hine). Abundant in Red River and Selkirk Settlements (Brewer). Prairie Portage; plains of the Souris (Hind). Portage la Prairie: Abundant summer resident on all the large prairie sloughs, in which they breed; first seen, May 11, 1884, May 25, 1885; last seen, September 9, 1884 (Nash). Breeding very abundantly in all marshes from Portage la Prairie westward, 1879, and in less numbers in the wooded region, but generally distributed (Macoun). Carberry: Abundant; summer resident; breeding also in all ponds along the trail from Carberry to Port Ellice (Thompson). Brandon: Breeds in great numbers (Wood). Shell River: 1885, first seen, eleven, on May 18; seen every day afterwards; is common all summer, and breeds here; Indian name, "K'ask" (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives May 18 (Gurnsey). Severn House (Murray).

On June 11, 1882, went in the morning with two brothers to the lake in the sand hills east of old Dewinton; saw there large numbers of marsh terns. They appeared to be nesting in a weedy expanse far out in the lake, but it was surrounded by deep water, so that I could not come near it to seek for eggs. The birds came flying over my head, in company with numbers of blackbirds, and resented my intrusion by continually crying in their characteristic manner.

August 4. The black terns are beginning to gather in flocks; leave the ponds and skim about over the open prairie.

On July 8, 1883, went southwest to Smith's Lake; found a number

of tern's nests, just finished, apparently, as they were clean, but empty, and the old birds continued flying above us and screaming their resentment.

On July 5, 1884, at McGee's Lake, Carberry, I found the terns just beginning to lay. Each nest is a mere handful of floating reeds, slightly moored to others growing in the deep water, where they are found. The whole structure is just on a level with the surface of the water and entirely wet; on this are the eggs, much the same color as the reeds, and as wet as eggs can be.

It is a remarkable fact that, although this species is abundant in all parts of southwestern Manitoba, and I have often searched in various lakes with a flock of terns screaming about my ears, yet I have never before found either nest or eggs. On this occasion I found three eggs in one nest; several nests with two eggs; one or two with one, and one or two empty nests just completed.

On July 9 the terns were numerous everywhere on the prairie. Timed and counted the wing beats of several as a basis for calculating their rate of flight; one made 54 beats in 9 seconds; another, 28 beats in 9 seconds, a third 30 in 10 seconds. July 6, observed one make 27 beats in 10 seconds. July 12, saw another make 15 beats in 5 seconds, showing that about 3 is the average number of beats to the second. July 5 I had an opportunity of measuring the distance a tern covers with 8 beats; it was 24 yards.

August 14: Terns are abundant now on the open prairie; it is a common sight to see this bird zigzagging about in pursuit of the large dragon flies, until, at length, having secured as many as it could conveniently carry, it suddenly ceased the fantastic maneuvering for the swifter beeline, and made straight for its twin nestlings in the reedy expanse of some lake far away.

To-day, I made a calculation of the speed; one bird covered 70 yards with 14 beats, *i. e.*, 5 yards per beat; I find they usually give 3 beats per second; this, therefore, is 15 yards per second or 31 miles per hour; much less than I expected. This black inland member of a white marine family is abundant about all the weedy sloughs and lakes of the Manitoban prairie regions. It seems not to subsist on fish at all, but chiefly on dragon flies and various aquatic insects. It finds both its home and its food in the marshes usually, but its powers of flight are so great that it may also be seen far out on the dry open plains scouring the country for food at a distance of miles from its nesting ground.

The voice of the species is a short, oft-repeated scream, and when any known enemy, be it man or beast, is found intruding on the privacy of their nesting ground the whole flock comes hovering and dashing about his head, screaming and threatening in a most vociferous manner. Under such circumstances it is the easiest thing imaginable to procure as many specimens as may be desired. When one of the flock falls wounded in the water, its fellows will repeatedly dart down and hover

low over it, but I have never seen any attempts made to assist it in escaping, after the manner ascribed to some of the family.

Besides aquatic insects the Black Tern feeds largely on dragon flies which it adroitly captures on the wing. The bird may frequently be seen dashing about in a zigzag manner so swiftly the eye can offer no explanation of its motive until, on the resumption of its ordinary flight, a large dragon fly is seen hanging from its bill and sufficiently accounts for the erratic movements of the bird. After having captured its prey in this way I have frequently seen a tern apparently playing with its victim, letting it go and catching it again, or if it is unable to fly, dropping it, and darting under it to seize it again and again before it touches the water. After the young are hatched, a small flock of the old ones may be seen together leaving the pond and winging their way across country to some favorite dragon-fly ground. Their flight at first is uncertain and vacillating, but as soon as one has secured its load it returns with steady flight and in a straight line to its nest.

Under ordinary circumstances I was always impressed with the idea that the tern was very swift and entered into a series of elaborate calculations to ascertain the rate of its flight. A large number of observations resulted in an average of three wing-beats per second, with the greatest of regularity; another series of observations, not so satisfactory, allowed a distance of 5 yards to be traversed at each beat. This gave only the disappointing rate of something over 30 miles per hour, but this was at the uncertain foraging flight. Once the mother tern has secured her load of provender, a great change takes place, as already mentioned; she rises high in air, and I am sure she doubles her former rate of speed, and straight as a ray of light makes for home. It is said that many birds can not fly with the wind; not so the tern; for now, if there be a gale blowing her way, she mounts it like a steed and adds its swiftness to her own, till she seems to glance across the sky, and vanishes in the distance with a speed that would leave far behind even the eagle, so long the symbol of all that was dashing and swift.

17. *Phalacrocorax dilophus*. Double-crested Cormorant. Crow Duck.

Summer resident about the large lakes of the westward region when there is plenty of fish; once observed on Red River near Pembina (Coues). Winnipeg: Summer resident; not rare, and found breeding at Lake Winnipeg; occasional on Red River (Hine). Breeding at Shoal Lake and Selkirk Settlement (D. Gunn). Shoal Lake: Plentiful; breeding; May 16, 1887 (Christy). Ossowa: Breeding (Wagner). Portage la Prairie: Tolerably common during the spring migration, on the Assiniboine and Red Rivers, and the wooded sloughs adjacent to them, but very seldom seen in the autumn; first seen April 24, 1885, April 20, 1886; on October 8, 1886; I saw one flying up the Red River southward; these birds are very wild and difficult of approach when on the water, rising with a great flapping before one can get within 200

yards of them (Nash). Very abundant; breeding on Lake Winnipegosis in 1881 (Macoun). Shell River: 1885, first seen, four, on May 13; next seen, two, on May 14; a transient visitor only; not breeding. (Calcutt). Qu'Appelle: Rather common summer resident; April 25, breeding north of the Touchwood Hills; nesting on the trees growing on islands in the lakes (Guernsey).

Fort Qu'Appelle, May 19, 1885. The Cormorant comes here in large flocks towards the end of April; it is called by half-breeds the Crow Duck; in its flight it flaps for three or four strokes and then sails; it is an expert diver. The half-breeds say that it builds on islands in the lakes north of here, building its nests on trees. They say that when a man lands on one of their breeding places the birds fly over him and drop their excrement on him. I have been told this by several. They do not breed here that I know of, but there are always several knocking about during the summer; they sit on the bars with the pelicans. (Geo. F. Guernsey).

18. *Pelecanus erythrorhynchos*. American White Pelican.

Common summer resident about the large lakes; one taken at Pembina in May; observed at Mouse River on the boundary in September (Coues). Winnipeg: Summer resident; common about the large lakes; breeding at Shoal Lake (Hine). Red River Valley: Summer resident; common; breeds at Shoal Lake (Hunter). Shoal Lake (Christy). Breeds in the smaller lakes near Lake Winnipeg, and northwestward; several specimens shot in Lake Winnipeg in October, 1880 (Bell). Swamp Island: 1885, first saw two on May 24; next seen May 31, after which it was common; it breeds here; in fall, last seen September 12, 1886, first saw, two, on April 29; bulk arrived May 27 (Plunkett). September 1, 1884, saw a flock of five on Lake Manitoba; the only ones I ever saw (Nash). Waterhen River: October 3, 1858, a large flock of pelicans, wheeling in circles far above, suddenly formed into an arrow-headed figure, and struck straight south; Oak Lake, some Pelicans (Hind). In great numbers at the head of Lake Winnipegosis or about half way up, and evidently breeding, 1881 (Macoun). Carberry: November 5, 1886, found remains of a dead pelican in the hills near Smith's Lake; only record (Thompson). Dalton: 1889, first saw one on May 4; next seen, May 5; rare (Yoemans). Qu'Appelle: Common summer resident; very plentiful on the lakes last year (1884); towards the migratory season I saw flocks of upwards of 500 birds (Guernsey). Pelican observed in numbers at the Grand Rapids, where the Saskatchewan enters Lake Winnipeg, on the 25th of September, and a few days after a scattered one or two; I believe they do not range east of Lake Winnipeg (Blakiston).

These birds until the last few years were in the habit of breeding in large numbers at Shoal Lake, 50 miles from Winnipeg. In the summer of 1878, on the 1st of June, I counted six hundred of their eggs (?) in nests on a small island of about half an acre in extent. The nests consist only of a slight depression in the sand. These birds and the cormorants are great friends; the nests of the latter were intermixed everywhere with those of the pelicans. I counted seven hundred eggs of the cormorant on this spot. Although the pelican's home and nesting place is an abode of filth, they keep

themselves exceedingly clean. Their flight I consider more beautiful and graceful even than that of the swan. (Richard H. Hunter in MSS.)

Fort Qu'Appelle, May 19, 1885. Some years the pelicans are more numerous than others. Last year they were very thick all summer, and towards the end of summer it was no unusual thing to see forty or fifty in a flock sitting on the water. They are reported to breed in large numbers on Long Lake, 40 miles west of here. (George F. Guernsey in MSS.)

19. *Merganser americanus*. American Merganser. Sheldrake.

Summer resident, frequenting only living water. Winnipeg: Summer resident; rare; Lake Winnipeg (Hine). Red River Valley: Summer resident; common; breeds at Shoal Lake (Hunter). Breeds abundantly on the rivers emptying into Lake Winnipegosis, and on all the rivers visited by me in Manitoba; I never observed this bird on still water during the breeding season; they feed only on fish, and are found only on clear running streams where fry are abundant (Macoun). Qu'Appelle: Tolerably common summer resident; May 5 (Guernsey).

20. *Merganser serrator*. Red-breasted Merganser. Fish Duck.

Summer resident, chiefly on living waters. Winnipeg: Summer resident; rare; Lake Winnipeg (Hine). Red River Valley: Summer resident; tolerably common; breeds at Shoal Lake (Hunter). Breeds in all the northern streams and ponds; feed largely on vegetable matter and are quite edible (Macoun). Carberry: August 21, 1884, at Hope's Lake, shot a merganser; rare here (Thompson). Qu'Appelle: Tolerably common; summer resident; May 1 (Guernsey). Trout Lake, Severn House (Murray).

21. *Lophodytes cucullatus*. Hooded Merganser.

Summer resident, chiefly inhabiting drainage, that is, dead water; breeds; Turtle Mountain and Mouse River along the boundary (Coues). Dufferin: Arrived between April 20 and 25 (Dawson). Winnipeg: Summer resident; common; breeding at Lake Winnipeg (Hine). Portage la Prairie: Tolerably common; summer resident; first seen April 27, 1885, April 23, 1886; abundant on La Salle River and on Horse Creek near Westbourne (Nash). Found in all the smaller ponds and lakes; very common in streams around the Porcupine Mountain; feeding on vegetable substances and quite edible, unlike *M. americanus* (Macoun). Carberry: Tolerably common summer resident; breeding (Thompson). Shell River: 1885, first seen, eight, on May 11; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives April 20 (Guernsey). Trout Lake (Murray).

22. *Anas boschas*. Mallard.

Very abundant; summer resident; general distribution in grassy freshwater marshes, etc.; breeds abundantly throughout the region in suitable places, from Pembina along the boundary to the Rockies

(Coues). Dufferin: Arrived between April 15 and 20 (Dawson). Winnipeg: Summer resident; abundant (Hine). Ossowa: Common; breeding; 1885, first seen, two, on April 6; next seen, April 13 (Wagner). Swampy Island: 1885, first seen, two, on April 16; next seen, April 20; became common April 26; breeds here in fall; last seen October 1; 1886, first seen, two on April 16; next seen, April 17; (Plunkett). Oak Point: 1885, first seen, two, on April 7; next seen, April 8; became common on April 11; breeds here (Small). Portage la Prairie: 1884, very common; summer resident; first seen, March 30; a few sometimes remain till after the snow covers the ground (Nash). The most abundant duck of the Northwest, breeding in nearly all the marshes north of the boundary (Macoun). Carberry: Abundant in migration; a few breed; Souris Plain; Turtle Mountain; Long River; Fingerboard; near Rapid City; near Two Rivers; Pine River; Portage la Prairie (Thompson). Brandon: April 13, 1882 (Wood). Dalton: 1889, first seen, four, on March 21; next seen on March 23; became common on March 26; breeds here (Youmans). Shell River: Common summer resident; breeds; in 1885, first seen, twelve, on April 6; afterwards seen every day (Calcutt). Qu'Appelle: Common summer resident; breeds April 5 to 15 (Guernsey). Trout Lake Station and Severn House (Murray). Near Cumberland House are found in vast multitudes (Hearne, 1773).

June 11: While roaming in Spruce Bush, to-day, I came suddenly across a wild duck (Mallard) with her newly hatched brood. She was leading them to the water, which was a considerable distance away, perhaps a quarter of a mile, and in this locality the forest was high and dry. The old duck ran to meet me and then put in practice all the usual stratagems to cover the retreat of her brood; meanwhile the little ones scattered and ran, "peeping" in all directions, and soon all had hidden themselves from view, except five, which I caught. The remaining four or five I did not try to get, but left them for the mother to gather together again. My little captives I took home with me, fondly believing I could rear them.

On October 30, 1886, saw three Mallard at Smith's Lake. I have often lain in the long grass on the bank of some pond and watched the whole family as they played about on the glassy surface, now splashing the water over the backs, apparently to show how they mean to do it when they are big rather than for any present benefit, and now rushing pattering over the surface in pursuit of some passing fly and generally with success crowning the effort, for when young they feed almost exclusively on insect food. I touched one of the tall stems so that the top shook; the watchful mother failed not to observe that there was something in the rushes, and slowly led her brood in another direction; or if I stood up in full view, she gave to her startled brood the watchword of alarm, which to judge from her actions may be translated "scatter and run for your lives into the rushes while I divert the brute's attention."

There have been times when it was the necessity for food that led me where I have observed such scenes as that described, but I can say truly that each time the brave mother was allowed to go in peace and the hunt was prolonged until another though perhaps a less palatable victim was found and sacrificed.

They arrive early in April, frequently before the lakes or large sloughs are free from ice, resorting to the wet prairies and stubble-fields; the great bulk are paired when they reach here and they soon commence nesting, their nests being made in all sorts of places. I have found them in the marshy sloughs on the open prairie, near water usually, and once in the bush at least a half a mile from a very small stream that always dried up during the summer, but which was the only water for a long distance.

About the middle of May the females commence to set; the drakes then molt, losing their brilliant plumage; whilst undergoing this change they gather together into small flocks of about five or six and hide themselves in the rushes, from which it is very hard to dislodge them even with good dogs.

In September they gather into flocks, young and old together, and visit the wheat and barley stubbles, rapidly becoming fat; the drakes at this time begin to show the green feathers on their heads, and by the time they leave they have acquired their perfect plumage.

A few frequently remain for some little time after the snow has covered the ground; these I have seen feeding around the base of the stacks and resorting to Lake Manitoba for water; in 1885 they were abundant up to November 9, but left on the day, after, for on the 11th I saw the last of the season, a single bird only.

On the 15th of September, 1882, I shot a large drake, which had pure white pinion feathers and a broad band of white from the usual ring around the neck to the breast; this bird was with seven others, all of the usual color and size. (Nash, in MSS.)

23. *Anas obscura*. Black Duck. Dusky Duck.

Very rare summer resident. Winnipeg: Summer resident; rare; only two specimens in 10 years, one at Long Lake, one at Lake Winnipeg (Hine). Red River Valley: Very rare; Manitoba is their most western limit (Hunter). I have received a specimen and seen others from York Factory (Blakiston).

24. *Anas strepera*. Gadwall. Gray Duck.

Rare summer resident; abundant throughout the region along the Boundary from Pembina to the Rockies; breeds (Cones). Winnipeg: Summer resident; tolerably common (Hine). Red River Valley: Summer resident; tolerably common at Lake Manitoba (Hunter). Breeding on Shoal Lake (D. Gunn). Only one specimen shot on the Assiniboine, September, 1881 (Macoun). Portage la Prairie: Rare; have shot a few in the autumn near Lake Manitoba (Nash). Qu'Appelle: Common summer resident; breeds; April 20 (Guernsey).

25. *Anas americana*. Baldpate, or Widgeon.

Tolerably common summer resident; abundant throughout the region along the boundary from Pembina to the Rockies; breeds (Cones). Dufferin: Arrived between April 20 and 25 (Dawson). Winnipeg: Sum-

mer resident; tolerably common (Hine). Selkirk Settlements: Breeding; Lake Winnipeg in the breeding season in considerable numbers (D. Gunn). Swampy Island: 1885, first seen, four, on May 10; next seen, May 11; bulk arrived May 12; is common, and breeds here; in fall, last seen, October 2; 1886, first four on May 10; bulk arrived on May 13 (Plunkett). A specimen from between Lake Winnipeg and Hudson Bay in Smithsonian Institution (Blakiston). Portage la Prairie: Abundant summer resident; breeding at Lake Manitoba and in all the sloughs in this vicinity; this is the last duck to arrive in the spring and the first to leave in the fall; in 1884, first seen, April 16 (Nash). Silver Creek: July 5, 1882, shot a Widgeon, female; apparently breeding; length, 18; extension, 33; gizzard full of shell-fish (Thompson). Shell River: 1885, first seen, a pair on May 12; next seen, four, on May 23; is common all summer, and breeds here (Calcutt). Frequent on the Assiniboine; 1881 (Macoun). Qu'Appelle: Common summer resident; breeds; April 20 (Guernsey).

26. *Anas carolinensis*. Green-winged Teal.

Abundant migrant; many breeding; extremely abundant throughout the region along the boundary from Pembina to the Rockies in August; doubtless some breed (Coues). Dufferin: Arrived between 15th and 20th (Dawson). Winnipeg: Summer resident; abundant; breeding (Hine). Swampy Island: 1885, first seen, two, on May 3; next seen, the bulk, May 6; is tolerably common, and breeds here; in fall, last seen September 1; 1886, first seen five on May 8; bulk arrived May 10 (Plunkett). Very common near Norway House; scarce northward (Bell, 1880). Portage la Prairie: 1884, abundant migrant and common summer resident, arriving at about the same time as the Mallard, but leaving as soon as the sloughs are frozen over; I have found flappers as late as the 15th of August (Nash). Rarely found breeding on the plains; apparently goes further north; in immense flocks on the Assiniboine in the fall of 1881 (Macoun). Carberry: common; breeding; Silver Creek, Rapid City (Thompson). Dalton: 1889, first seen, two, on April 15; next seen on April 16, when it became common; does not breed here (Youmans). Brandon: April 20, 1882 (Wood). Shell River: 1885, first seen, a pair on May 2; afterward seen every day; is common all summer, and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds April 5 to 15 (Guernsey).

On June 29, 1882, at Rapid City, Dr. A. S. Thompson shot a Green-winged Teal with his rifle. Although shot through the belly it was not killed, but flew with its entrails trailing, and it required a charge of dust shot to finish it. It was a male; length, 15; extension, 23; gizzard full of shell fish. This species is very abundant throughout the whole of the pondy prairie region from here to Carberry. It is usually met with in pairs and is of a very affectionate disposition, for if one be shot the other either remains to share its fate, or if it does fly at first, usually

returns almost immediately to the side of its mate. I found it an expert diver, for often one of them would disappear at the approach of the gunner and be seen no more; doubtless it had swam under water to the nearest reed-bed, in whose friendly shelter it was securely hiding.

On July 5, at Silver Creek, came across a female Green-winged Teal traveling with her brood of ten young ones across the prairie towards a large pool. The mother bird was in great grief on finding that she was discovered, but she would not fly away; she threw herself on the ground at my feet and beat with her wings as though quite unable to escape and tried her utmost to lead me away. But I was familiar with the trick and would not be beguiled. I caught most of the tiny yellow downlings before they could hide and carried them carefully to the pool, where soon afterward the trembling mother rejoined them in safety.

This species, I think, unlike the blue-wing, usually nests quite close to the water, so that it was probably owing to the drying up of the pond that this newly hatched brood found themselves forced to take an overland journey of considerable extent before they could find a sufficiency of water.

27. *Anas discors*. Blue-winged Teal.

Very abundant; summer resident; general distribution in the prairie regions; along the boundary, Mouse River, in fore part of August becomes very abundant; doubtless breeds (Coues). Winnipeg: Summer resident; abundant; breeding (Hine). Sparingly at Shoal Lake and Lake Winnipeg (Brewer). Swamp Island: 1885; breeds here; last seen August 26 (Plunkett). Shoal Lake, May 19, 1887 (Christy). Portage la Prairie: Very abundant; summer resident, and like the mallard nesting wherever it takes a fancy to do so; in 1884 first seen April 16 (Nash). Breeds abundantly around marshy ponds in the prairie country; exceedingly abundant in fall of 1880; rare in Assiniboine in September, 1881 (Macoun). Carberry: Common; breeding; Souris Plains, Turtle Mountain, Long River, Rapid City, and the whole south slope of Riding Mountain (Thompson). Dalton: 1889, first seen, one on April 18; next seen, May 15, when it became common; breeds here (Youmans). Shell River; 1885, first seen, a pair on May 2, afterwards every day; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds May 10 (Guernsey).

I have frequently remarked that during the breeding season this species may be seen coursing over and around the ponds in threes, and these when shot usually prove a male and two females. After dark they may be identified during these maneuvers by their swift flight and the peculiar chirping, almost a twittering, that they indulge in as they fly.

On August 19, 1882, at Markle's Lake, shot a Blue-winged Teal. This sheet of water is not more than 3 acres; it has hard banks, almost entirely without rushes or other cover, and is a mile or more from the

nearest pond. This duck is very abundant in the country, and I think it usually nests much farther from the water than any of its near congeners. Like the Green-wing it is a good diver, but it is less wary and more easily shot; it seems to prefer the smaller ponds and leaves the large sheets to the Mallard and other large ducks.

28. *Anas cyanoptera*. Cinnamon Teal.

Very rare; straggler; I have taken the Cinnamon Teal at Oak Lake, and I think also at Lake Manitoba, but during fifteen years' residence in Manitoba I have only seen five or six specimens (R. H. Hunter).

29. *Spatula clypeata*. Shoveler or Spoonbill.

Abundant summer resident, of general distribution; abundant throughout the region along the boundary from Pembina to the Rockies; breeding on Mouse River (Cones). Dufferin: Arrived between April 20 and 25 (Dawson). Winnipeg: Summer resident; abundant (Hine). Breeding at Red River, Shoal Lake, and Lake Winnipeg (Brewer). Swampy Island: 1886, first seen, six, on May 28; abundant summer resident (Plunkett). On Lake Winnipeg, the young were nearly full grown in the beginning of July (Bell, 1880). Shoal Lake: Breeding May 17, 1887 (Christy). Portage la Prairie: 1884, common summer resident; breeds in most of the sloughs near here; I have only once seen anything like a flock of these birds, and then there were not more than a dozen of them; they arrive late and depart as soon as the shallow waters they frequent are frozen; in 1884, first seen April 16 (Nash). Observed great numbers in August on the prairie ponds about Pleasant Hills; breeding on ponds throughout the prairie, but more abundantly throughout the copsewood region (Macoun). Brandon, Pembina, and Rapid City: Breeding (Thompson). Dalton: 1889, first seen, one on April 16; is common, and breeds here (Youmans). Shell River: 1885, first seen, a pair on May 8; next seen, four on May 22; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; May 1 (Guernsey). Trout Lake (Murray).

30. *Dafila acuta*. Pintail.

Common summer resident of general distribution; abundant throughout the region along the boundary westward from Pembina, in summer as well as in fall (Cones). Dufferin: Arrived between April 15 and 20 (Dawson). Winnipeg: Summer resident; abundant (Hine). Red River to Hudson's Bay (Blakiston). Breeds near Norway House (Bell, 1880). Osowa: Common; breeding; 1885, first seen, one on April 7, next seen April 16; became common April 20; last seen, thirteen, on November 1 (Wagner). Portage la Prairie: Abundant; summer resident; first seen in 1884, April 16; arriving early, generally with the Mallard, but leav-

ing much earlier, the first frost driving them out (Nash). Carberry: Tolerably common summer resident; breeding; Souris Plain, Turtle Mountain, Fingerboard, near Rapid City (Thompson). Dalton: 1889, first seen, about ten, on March 21; seen every day afterwards; became common on March 23; breeds here (Youmans). Brandon: April 9, 1882 (Wood). Breeding on the prairies south of Pipestone Creek (Macoun). Shell River: 1885, first seen, four, on April 20, afterwards seen every day, male and female; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds April 5 to 15 (Guernsey). Trout Lake Station and Severn House (Murray).

31. *Aix sponsa*. Wood Duck.

Rare summer resident; several small flocks in latter part of September, north of Red River, in Minnesota, feeding on wild rice (Kennicott). Rat Portage: October 10, 1886, found the head of a male Wood Duck lying on the shore (Thompson). Winnipeg: Summer resident; rare (Hine). I have seen the Wood Duck (*Aix sponsa*) at Westbourne, and it is always to be found along Cook's Creek, east of Winnipeg (Hunter). Portage la Prairie: A rare and local summer resident, but I think increasing; previous to September 21, 1884, I never saw any in this neighborhood, though I had heard that a few pairs always bred on the White Mud River, near Westbourne, on that day; I saw two on the Assiniboine the following year; two or three broods were raised here, out of which, in September, I shot several, and on the 9th of October I killed one of the handsomest drakes I have ever seen; its plumage was simply perfect (Nash). Observed on Lake Winnipegosis by Mr. Tyrrell (Macoun). Carberry: A single pair taken in 1883 (Thompson). Qu'Appelle: I know of one being shot here in five years (Guernsey). A male killed at Cumberland House, June, 1827 (Richardson). Mr. Hine, of Winnipeg, showed me some fine specimens taken at Lake Winnipeg; he described it as regular, though not common, in the mouths of such creeks as flow through the heavy timber into Lake Winnipeg; Devils' Creek is a favorite place, and here they are found feeding largely on the wild potato which grows on the overhanging banks, so that the bird may gather it without leaving the water; Hudson's Bay; Moose Factory; Trout Lake Station (Murray).

32. *Aythya americana*. Red-head.

Common summer resident; breeding abundantly throughout the region along the boundary from Pembina to the Rockies (Cones). Swamp Island: Breeds here; last seen September 11 (Plunkett). Winnipeg: summer resident; abundant (Hine). Breeding at Oak Point Lake, Manitoba, Shoal Lake, and Selkirk Settlement (D. Gunn). Portage la Prairie: Abundant; summer resident; breeding in all the lakes and large sloughs; I have frequently shot flappers on the 15th of August; they arrive as soon as the rivers are open and stay until no open water

is left; in 1884, first seen April 16 (Nash.) Breeds abundantly on the marshes of Waterhen River (Macoun). Carberry: Tolerably common; summer resident; breeding (Thompson). Shell River: 1885, first seen, a pair on May 3, afterwards seen every day; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; April 23 (Guernsey).

Oak Point. We procured some duck nests and among them were two *Aythya americana*, (Red-head ducks' nests), one containing eight eggs, the other nineteen. When I was there in 1865 we found one belonging to the same kind of duck containing nineteen or twenty eggs. The Indians accuse this duck of dishonesty, stating it to have very little respect for the rights of property, being inclined to rob other ducks of their eggs and place them in its own nest. This species and the canvas-back are both found at Shoal Lake and at Manitoba, but nowhere in great numbers. (D. Gunn.)

33. *Aythya vallisneria*. Canvas-back.

Uncommon; a few breed; at Turtle Mountain in July (at the boundary) I saw several broods of partly grown young; in most of the region, however, the bird is less numerous than the Red-head (Coues). Winnipeg: Fairly common on Lake Manitoba, but not generally breeding (Hine). Red River Valley: Transient visitant; rare (Hunter). Oak Point and Shoal Lake: breeding (Gunn). Swampy Islands: 1885, first seen, sixty, on May 19; next seen, May 20; last seen May 25; does not breed here; is very abundant in fall and spring amongst open places in ice on lake (Plunkett). Portage la Prairie: 1884, first seen April 16; common in spring, particularly if the lowlands should be flooded; in 1882, during the spring freshet they were abundant, in the autumn; they are less frequently seen; some, however, breed on Lake Manitoba, for on the 18th of September, 1886, I saw four young birds in a game dealer's shop in Winnipeg, the proprietor of which told me he had just received them from there, and a friend who knows the birds well also informed me that he had shot them on the same lake when they could scarcely fly (Nash). Qu'Appelle: Common migrant; April 23 (Guernsey).

I am positive that the canvas-back never breeds in Manitoba. I have shot in the spring every year for the past fifteen years, and have not seen ten canvas-back ducks during that time. I have occasionally shot them in the autumn, in the proportion of one canvas-back to two hundred other ducks. (Rich H. Hunter, in MSS., May, 1885.)

34. *Aythya marila nearctica*. American Scaup Duck. Big Blue-bill or Black-head.

Common migrant; a few breed. Dufferin: Arrived between April 25 and 30 (Dawson). Specimen in Smithsonian Institution, from Red River Settlement (Blakiston). Winnipeg: Abundant (Hine). Red River Valley: Abundant migrants, but I can not concur that it commonly breeds in Manitoba (Hunter). Breeding at Lake Winnipeg (D. Gunn). A few breeding in Lake Winnipegosis, June, 1881 (Macoun). Portage la Prairie: Fall migrant; common in spring, arriving as soon

as the rivers are open ; not so frequently obtained in the autumn, principally, I think, because it confines itself to the large lakes, seldom visiting the creeks or sloughs at that season ; it remains until it is frozen out ; in 1884, first seen April 16 (Nash, in MSS.).

Carberry : Abundant ; migrant (Thompson). Qu'Appelle : Common summer resident ; breeds ; arrives April 20 in flocks, with lesser Blue-bills and Ring-neck (Guernsey).

35. *Aythya affinis*. Lesser Scaup Duck. Little Blue-bill.

Abundant summer resident, of general distribution. Winnipeg : Abundant ; breeding (Hine). Red River Valley : Abundant, chiefly in autumn ; not commonly breeding (Hunter). Swamp Island : 1885, first seen, four, on May 12 ; next seen May 13, when it becomes common ; is abundant and breeds here ; 1886, first seen, two, on May 5 ; bulk arrived on May 11 (Plunkett). Shoal Lake : May 19, 1887 (Christy). Portage la Prairie : Abundant summer resident ; breeding on all the prairie sloughs of any size ; it arrives as soon as there is any open water, and remains so long as there is a hole in the ice big enough to hold it ; in 1884, first seen April 16 (Nash). Breeding more commonly than the preceding (1881) (Macoun). Carberry : Abundant summer resident ; breeding ; Brandon, Souris Plain, south slope of Riding Mountain (Thompson). Shell River : 1885, first seen, two pair, on May 1 ; afterwards seen every day ; it is common all summer and breeds here (Calcutt). Qu'Appelle : Common summer resident ; breeds ; arrives April 20 (Guernsey). Severn House (Murray).

36. *Aythya collaris*. Ring-necked Duck. Marsh Blue-bill.

Tolerably common summer resident. Winnipeg : Summer resident ; common (Hine). Swamp Island : 1885, first seen, six, on May 9 ; next seen, the bulk, on May 10 ; tolerably common ; breeds here (Plunkett). Breeding in the marshes of Waterhen River, 1881 (Macoun). Portage la Prairie : Common summer resident ; frequently confounded with the last, and they are both frequently more than confounded by persons who shoot them, for if there is only one kick left in them when they drop they will utilize that to such good purpose that they will get under cover beneath the water, where they conceal themselves so well that it is almost useless to try to retrieve them (Nash). Qu'Appelle : Common summer resident ; breeds ; arrives April 20 (Guernsey).

37. *Glaucionetta clangula americana*. American Golden-eye. Whistler. Tree Duck.

Rare summer resident. Winnipeg : Summer resident ; tolerably common (Hine). Red River Valley : Summer resident ; tolerably common ; I have taken twenty-one eggs out of one nest in an old oak tree at Shoal Lake, near Winnipeg (Hunter). Swampy Island : 1885, first seen, six, on May 5 ; next seen on May 6 ; became common May 8 ; is

tolerably common, and breeds here (Plunkett). "Common Golden-eye or Tree Duck;" also breeds near Norway House (Bell, 1880). Portage la Prairie: Rare; summer resident; comes late and leaves early; is scarce in the shooting season; shot one in August, and as I see them more or less all summer, I assume that they breed here; arrives about the end of April and departs early; I have rarely seen one after the 1st of September; first seen April 27, 1885, April 20, 1886 (Nash). A few breed in the Waterhen River marshes (Macoun). Carberry: Very rare; summer resident; June 23, 1883; at a small lake in the woods to the south, to-day, I saw a Whistler, and I think the species breeds here (Thompson). Shell River: 1885, first seen, one, a male, on April 25; a transient visitor, passing north and not remaining any time or breeding (Calcutt). Qu'Appelle: Tolerably common summer resident; breeds; arrives April 15 (Guernsey).

38. *Glaucionetta islandica*. Barrow's Golden-eye.

I shot a brace at Lake Manitoba in 1879, and a drake at Shoal Lake in the spring of the following year; and I saw a drake which was killed at the mouth of the Red River (Hunter). Winnipeg: Rare; straggler (Hine).

39. *Charitonetta albeola*. Buffle-head.

Common summer resident; breeding in deep ponds that are fringed with trees; among the commonest species after the fall migration, along the boundary (Coues). Dufferin: Arrived between April 20 and 25 (Dawson). Winnipeg: Transient visitor; abundant (Hine). Swamp Island: 1885, first seen, about twenty, on May 21; next seen on May 22; last seen, May 25; is common in migration but does not breed; 1886, first seen, six, on May 10; bulk arrived May 13; last seen, May 19 (Plunkett). Portage la Prairie: Abundant in spring and autumn, some few remaining to breed; at Lake Champique, near Hedingly, I once found young, unable to fly, on the 15th of August; they were on a prairie slough, at least three miles from any trees (Nash). Abundant in ponds in the autumn; not seen in the prairie regions (Macoun). Carberry: Common summer resident; breeding also at west slope of Duck Mountain, Portage la Prairie (Thompson). Shell River: 1885, first seen, two, on April 27; next seen, May 20; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives September 20 (Guernsey). Severn House; Trout Lake Station (Murray).

40. *Clangula hyemalis*. Old squaw. Swallow-tailed Duck. Coween.

Severn House (Murray), and during winter found in many parts of the Mississippi valley (Cook), therefore probably Manitoban.

41. *Histrionicus histrionicus*. Harlequin Duck.

This bird will probably be found in Manitoba, as it has been recorded from near Hudson's Bay (Hutchins). Breeds in British America; * * * throughout Illinois in winter, and has been taken at St. Louis, Missouri (Cooke). Breeding in the Rocky Mountains, near the boundary (Coues).

Pow is tic on sheep; two specimens, both drakes, etc. * * * These birds are found in small rivulets, seldom in large rivers, about 90 miles inland. They migrate to the southward with the geese; feed on grass and small worms at the bottom of the creeks; have a whistling note; they build their nests in the grass, and lay ten or more eggs, resembling those of a pigeon in size and color. The name in the Algonquin language implies a species of ducks that frequent the waterfalls or cataracts. The young brood are very prettily speckled. (Hutchins MSS. Obs. H. Bay, 1782.)

42. *Oidemia americana*. American Black Scoter.

Rare; migrant. Winnipeg: Transient visitor; rare (Hine). Swampy Island: "Black Duck," 1885, first seen, four, on May 19; next and last seen on May 20; is rare here and does not breed (Plunkett). Trout Lake (Murray).

43. *Oidemia deglandi*. White-winged Scoter.

Rare; migrant; possibly breeding. Winnipeg: Summer resident; tolerably common; Lake Winnipeg (Hine). Red River Valley: Transient visitor; tolerably common on rocky localities (Hunter). Occurs between Hudson's Bay and Lake Winnipeg (Murray). Near Russell, July 6, 1882; Bitter Lake, Washington, shot a velvet scoter, female; length 20, extension 36; all over dusky; bill gray; a light patch near bill and one behind eye; secondaries white; legs dull reddish; apparently breeding (Thompson). Qu'Appelle: Common; migrant; May 1 (Guernsey). Trout Lake Station; Severn House (Murray).

44. *Oidemia perspicillata*. Surf Duck or Surf Scoter.

Uncommon; migrant; common at Lake Winnipeg (Hine). Qu'Appelle: Rare migrant; May 1 (Guernsey). Red River Valley: Tolerably common; transient visitor; abundant (Hunter). A specimen from Nelson River in the Smithsonian Institution (Blakiston).

45. *Erismatura rubida*. Ruddy Duck.

Summer resident; breeding; common and breeding in suitable places throughout the region along the boundary; at Turtle Mountain nesting in numbers in the pools (Coues). Winnipeg: At few are seen each year about Long Lake when it breeds; also Lake Winnipeg, and at Shoal Lake (Hine). The Ruddy Duck is sometimes found in swamps near the Red River, but they are more numerous at Shoal Lake and Manitoba (D. Gunn). Portage la Prairie: Shot a female here September 10, 1884; she was with two buffle-heads at the time (Nash). Seen at

Touchwood Hills in September, but not in Manitoba (Macoun). Shell River: 1885, first seen, one male, on May 23; breeds here; flaps for a few yards on the water and spreads its tail and shakes its head like a fan-tail pigeon (Calcutt). Qu'Appelle: Common summer resident; breeds May 1 (Guernsey).

46. *Chen caerulescens*. Blue Goose.

Winnipeg: Rare; transient visitant (Hine).

47. *Chen hyperborea*. Snow Goose; White Wavy.

Abundant spring migrant; less common in the fall; abundant during migration along the boundary (Cones). Winnipeg: Transient visitor; abundant; going north to breed (Hine). Red River Valley: Transient visitor; abundant (Hunter). Swampy Island: 1835, first seen, four, on May 7; next seen on May 10, after which it disappeared; never common; does not breed, and is rare on this lake (Plunkett). Migrant at Shoal Lake (Gunn). Ossowa (Wagner). Portage la Prairie: 1884, abundant spring visitor to the large grass marshes near Portage la Prairie, but rarely seen in the autumn in that neighborhood; near Winnipeg it is, however, not uncommon in October; first seen April 23, 1884 (Nash). Carberry: Seen in enormous numbers in spring, and in much less numbers in the fall (Thompson). Little Saskatchewan, near St. Martin's Lake: Wavies, as the half-breeds term them (Wa-wain Cree) (*Anser hyperboreus*), flying to the south early this morning in large flocks, were regarded as a sure sign of approaching winter (Sept. 27, 1858, Hind). Two Rivers: 1885, first seen, one, on April 6; next seen, four, on April 18; migrant (Uridle). Qu'Appelle: Transient; passing over May 3 to 28 (Guernsey). Severn House (Murray).

In Hudson's Bay they are the shyest and most watchful of all the species of geese, never suffering an open approach, not even within two or three gunshots. Yet in some of the rivers near Cumberland House and at Basquian the Indians frequently kill twenty at one shot; but this is only done in moonlight nights, when the geese are sitting on the mud and the sportsmen are perfectly concealed from their view. (Hearne, 1795.)

In April the ducks and geese return in great numbers, become plentiful, and feed in numerous flocks in all the marshes fringing the lakes for at least a month and a half. The gray geese and ducks draw off by degrees in May, but the white geese (wawee) come generally in the last week of April, and begin to clear away for Hudson's Bay on the 13th or 14th of May, where they invariably arrive on the 15th of May. The last of them leave here from the 20th to the 25th of the same month. (D. Gunn.)

These birds pass over the country in countless numbers each spring, generally arriving in large bands about the 15th of May, although I have seen stragglers as early as the 28th of April. A great number of immense flocks generally remain in the Province for a couple of weeks to "take in sand" and feed. They are very easily shot while on the gravel grounds; they appear very stupid (*i. e.*, in the morning and evening). When not taking in sand and gravel they are very difficult to approach and are as wary as any geese. These birds are rarely seen in the autumn. The half-

breeds say that they do not pass over Manitoba on their return, but take a more western course. Although I have spent two weeks every October for the past 15 years in shooting, I have never seen more than an occasional flock of perhaps fifty birds in the autumn. (Hunter, in MSS.)

48. *Anser albifrons gambeli*. American White-fronted Goose. Laughing Goose. Specklebelly.

Winnipeg: Migrant; transient visitor, rare (Hine). *Anser frontalis* of Baird from Red River Settlement (Blakiston). Ossowa: Migrant; May 11 (Wagner). Shell River, 1885, first seen, eighteen, on April 10; a transient visitor, passing north and not breeding or remaining any time (Calcutt). Near Long River, May 19, 1882, C. T. shot a pair of White-fronted Geese, but secured only the male; length, $27\frac{1}{2}$; extension, 58; testes but little developed; gizzard full of young shoots of aquatic plants; a peculiar wart or excrescence grew on the tibio-tarsal joint. No others of the species were seen (Thompson). Near Cumberland House and Basquiau they are found in such numbers that the Indians in moonlight nights frequently kill upwards of twenty at a shot (Hearne, 1795).

49. *Branta canadensis*. Canada Goose. Wild Goose. Wavy.

Abundant; migrant; a few breed; common at boundary along Mouse River in late September (Cones). Winnipeg: Summer resident; abundant; a few breed (Hine). Red River Settlement: April 2, 1856, April 1, 1858 (Blakiston). Red River Valley: Abundant in migration; a few breed (Hunter). Breeding on Lake Winnipeg in June (Kennicott). Swamp Island, 1885: First seen, eighteen, on April 14; next seen April 15, when it became common; breeds here; in fall; last seen September 23, 1886; first seen, four, on April 8; bulk arrived April 16 (Plunkett). Ossowa: Common; breeding, 1885; last seen, fifteen, on November 28 (Wagner). Oak Point, 1885, April 7 (Small). Portage la Prairie: Common in spring and fall; a few breed in the marshes near Lake Manitoba; arrives about the middle of April or before should there be open water; departs when all the lakes and rivers are frozen over, usually about the 10th of November (Nash). In 1879, breeding on the Assiniboine, where Brandon now is; also above the rapids (Macoun). Two Rivers, 1885: Great flight April 1; next April 3; common in spring and fall (Criddle). Brandon: Two young taken on the river August 25, 1882 (Wood). Dalton, 1889: First seen, about fifteen, on March 21; next seen on March 22; became common on March 26; was last seen May 10; rarely breeds here (Yoemans). Shell River, 1885: First seen, fifteen, on April 9; afterwards seen nearly every day in the migrating season; odd pairs breed near here (Calcutt). Qu' Appelle: Common summer resident; breeds April 1 to 10 (Guernsey). Carberry: Abundant in migration; rarely breeding south of Souris River; migrant; breeding near Shoal Lake, west (Thompson).

On October 4, 1883, near Shoal Lake, west, I chanced to call at the home of Mr. McMillan, a farmer. There was a flock of six full-grown tame Canadian Geese feeding about the door. Mrs. McMillan informed me that in the spring they found the old goose nesting in the slough near by. The bird was shot, and her seven eggs brought into the house and laid by the stove during the daytime, and at night they were wrapped in flannel and put away. At length they began to hatch. The good wife assisted six of the goslings into the world, but, fearing she had done wrong, allowed No. 7 to work his own passage. The six lived and thrived, while No. 7 died. (In the spring of 1884 she still had the brood of swan-like birds; they were living in the barnyard in a state of perfect domestication.) The fact that these eggs must have been chilled nightly, and in the daytime exposed to a dry, unnatural heat, shows the wonderful vitality possessed by wild eggs.

Another farmer, living near Carberry, added some geese to his barnyard in the same way, but, I believe, they did not breed in confinement.

49a. *Branta canadensis hutchinsii*. Hutchins's Goose.

In September a very small young bird, taken on Red River by Robert Kennicott (Baird). Portage la Prairie: Common in spring and fall only; have not been able to discover that it breeds near here (Nash).

50. *Branta bernicla*. Brant.

Migrant; observed only during the migration along the boundary (Coues). Winnipeg: Transient visitor (Hine). Red River Valley: Transient visitor; I have taken it at Shoal Lake (Hunter). Carberry: Observed as a migrant; not common; no specimen taken (Thompson).

51. *Olor columbianus*. Whistling Swan.

Occasional about the large lakes; not demonstrated to breed. Winnipeg: Transient visitor; rare (Hind). Oak Point, 1884: Arrived May 4 (Small). Always seen in flocks high up (Macoun). Portage la Prairie: In the autumn of 1886 saw one that had been shot on Lake Manitoba, and in previous years have seen this or the next species there myself (Nash).

Some years ago, when I built Cumberland House, the Indians killed those birds (swans) in such numbers that the down and quills might have been procured in considerable quantities at a trifling expense. (Hearne, 1769-1772.)

52. *Olor buccinator*. Trumpeter Swan.

Rare migrant; observed on a few occasions in Dakota late in September and in the first half of October during the migration; said to breed in Minnesota (Coues). Winnipeg: Transient visitor; rare (Hine). Swamp Island, 1886, first seen, eight, on May 1; bulk arrived May 6; last seen May 10; tolerably common this year (Plunkett). Portage la

Prairie: Occasionally seen in spring and autumn, I am informed, but as I never actually identified the bird myself I am not positive about it (Nash).

53. *Botaurus lentiginosus*. American Bittern.

Common summer resident in all extensive marshes; apparently rather common on Mouse River, at the boundary, in September (Coues). Dufferin: Arrives between April 25 and 30 (Dawson). Morris: Often seen April 29, 1887 (Christy). Winnepeg: Summer resident; abundant (Hine). A specimen in Smithsonian Institution, from Nelson river (Blakiston). Ossowa: Breeds (Wagner). Oak Point: 1884, arrived May 15 (Small). Portage la Prairie: Common summer resident; first seen May 17, 1884; May 22, 1885; April 19, 1886; last seen October 16, 1884 (Nash). Abundant in all marshes throughout the country; shot June 11, 1881 (Macoun). South slope of Riding Mountain, on Little Saskatchewan, August 28, 1858; in the marshes, herons, cranes, and bitterns were distributed in groups (Hind). Carberry: Common; southern slope of Riding Mountain, abundant; Portage la Prairie; Sewell; Fort Ellice; Rat Portage, 1886 (Thompson). Shell river 1885, first seen, one on May 4, afterwards seen every day; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives May 21 (Guernsey). Severn House (Murray).

On May 23, 1884, at Sewell Plain, heard a bittern pumping in the slough after dark; the sound has been very aptly likened to the syllables "pump-o-ga;" the first two notes are like the stroke of a pump, the last is exactly like the swish and gurgle of water in a deep pipe. This sound is not at all ventriloquial, as is that of the European Bittern according to many accounts, and I had no difficulty in following and flushing the bird, but it was too dark to shoot, as I could only see the dim form against the sky when it rose after flying, apparently 50 yards, and presently he was heard again working his pump in the distance.

On June 2, on the south slope of the Riding Mountain, I was led to a bittern, after sundown, by its pumping; I watched it catching insects until dark, and then shot it, and found in its stomach a most miscellaneous collection of insects, etc. Same day, near the Fingerboard, I traced a bittern by his note in the evening, and shot him; ♂ adult; stomach contained crawfish, insects, a garter-snake, a mouse, and a menobranchus.

June 3, at Rapid City Trail, south slope of Riding Mountain. The bittern is one of the commonest of the large birds that are to be found in this region. Its long brown form on flagging wing, with beak pointed one way and legs another, is to be seen flying over nearly every extensive slough of this region. Suddenly, in the midst of his flight, he may be seen to dangle his legs, "reverse action" his wings, and drop into the marsh. There, for a moment, he stands, not deigning to notice the blackbirds that are trying to terrify him into a retreat, his long neck

straight up at full length. Then, having satisfied himself that all is right, he touches a hidden spring, and instantly the preposterous neck is tucked away somewhere in a surprising way, and so effectually that the head looks as though stuck on the shoulders without any intervening structure at all.

In taking its prey the bird either waits until the rash victim comes within reach of its spear-like bill or goes stalking about after it among the rushes. Its food is of such a varied character that one only has to collect the stomachs of about a score of bitterns to have an extensive natural history museum. The specimen taken yesterday contained, as already stated, a garter-snake, a mouse, an amblystoma or water lizard, sundry crawfish, and an innumerable company of various insects; and to this list may safely be added every kind of small animalism that may be secured about the marshy home of the bird. Misled by sundry printed statements, I once cooked an individual of this species, but will not be so misled any more. It is sufficient to say that it tasted of all the creatures it feeds on.

I have somewhere read that this bird is strictly diurnal. This I have long doubted. Indeed, I begin to doubt that any bird is strictly anything. When we find a hawk gorging itself with choke cherries, a night-owl hunting by sunlight, and sandpipers that never pipe or go near sand, one is prepared to give up, on behalf of the birds, all rules of life and conduct, and expect the strictly "diurnal" bittern to be up and stirring during the hours of darkness and gloom, as, indeed, the foregoing notes lead me to suspect he does.

Contrary to the usually expressed opinion, this bird is strictly diurnal in its habits; quitting its resting places in the reedy bogs early in the morning, feeding out along the margins of ponds, streams, etc., during the day, and returning to its close cover at night. When alarmed, the bittern, instead of rising, frequently erects its head and neck and depresses its tail between its legs, until the whole body is almost vertical, and so stands perfectly still until the danger is past; when in this position it so closely resembles a dead branch that it requires a practiced eye to detect it. Bitterns are most frequently heard to boom or pump in the spring, but I have also heard them all through the summer; the latest date being in August. (Nash.)

54. *Botaurus exilis*. Least Bittern.

Accidental visitant. Winnipeg: Summer resident: only one specimen in 10 years in Manitoba (Hine).

55. *Ardea herodias*. Great Blue Heron.

Uncommon summer resident, of erratic distribution; common summer resident in all Red River Valley; not noted by me anywhere in the Assiniboine region; observed during our passage down the Red River to Pembina (Coues). Pennawa River, September, 1887 (Hind). Winnipeg: Summer resident; tolerably rare (Hine). Red River Valley: Summer resident; common at Shoal Lake, township 16, range 3, east

(Hunter). Portage la Prairie: 1884; rare; summer resident (Nash). South slope of Riding Mountain, on Little Saskatchewan River: In the marshes herons, cranes, and bitterns were disturbed in groups (Hind). Occasionally seen, but not very common; shot on Swan River, April 28, 1881; not observed breeding (Macoun). Breeding in numbers on Riding Mountain (Green). Qu'Appelle: Tolerably common; summer resident; breeds; arrives May 6 (Guernsey).

My summer of 1880 was spent in the Northwest Territory of the Dominion. The 20th of July last found me in the Duck or Riding Mountain, at the headwaters of Bird's Tail Creek, about 51° north, and on the one hundred and first meridian. These mountains are covered with a dense forest of tall poplars and birch and thick underbrush of hazel and raspberry, making it impossible to get through without cutting a trail in advance. This 20th of July was a very hot day. We had started at 6 a.m. with a train of thirteen heavily loaded carts, and by 11 a.m. had made about 3 miles, when a very peculiar noise saluted our ears. Knowing this forest to be full of bears, we at once came to the conclusion that we were in the vicinity of a family (sisters, cousins, and aunts) of those affectionate creatures. The train was ordered to halt while the chief of the party and myself went forward to prospect. As we advanced the noise grew louder and louder, till we called a council of two to decide what had better be done—face the enemy or draw on our reserves and advance in full force. While deliberating, the chief happened to cast his eyes heavenwards and the mystery was explained. We had struck a heronry; hundreds of these birds were passing to and fro; and on going forward a hundred yards or so we found the tops of the poplars covered with their nests, the young birds, full grown but not able to fly, perched on the highest branches of the trees. Here in the heart of a dense forest, probably never trodden by man before, were thousands of nests of our common Blue Heron (*Ardea herodias* Linn.) We cut down several trees and captured the young, which were cooked and eaten by some of our men with relish, probably because it was the first fresh food for three months. The nests were made of the small dead branches of the poplar and were placed as near the tops of the trees as possible. I kept two of the young birds alive for a few days, when, becoming able to fly, they took their departure.

These mountains are full of small ponds and bottomless marshes, which swarm with lizards and small fish, on which the herons feed, and on getting to an open space near the herony we could see the old birds coming and going in every direction. Those coming home were stuffed to the bill with food for their young, making them present a very ungainly figure, as they lazily flopped their way towards the woods. On pushing our way through this mountain forest, we discovered three good-sized lakes, about one-half mile wide, and from 1 to 2 miles in length each. We tried them for fish, but only caught a few common chub.

56. *Ardea virescens*. Green Heron.

Rather common in the Assiniboine, near the mouth of Shell River, September 25, 1881. This was certainly a heron, and was certainly not the Night Heron, as it was much smaller; it had no plumes, and was green on the wing shoulders; there were at least a dozen of them; they were in the trees along the river, not far from Mr. Henry Denmark's house (Macoun). Taken them at Shoal Lake, near Winnipeg, and am told that they breed in the sloughs around Turtle Mountains; they are rare compared with the number of Blue Herons (R. H. Hunter).

57. *Nycticorax nycticorax nævius*. Black-crowned Night Heron.

A somewhat common summer resident in Red River Valley; one individual seen during our passage down Red River to Pembina (Coues). Winnipeg: Summer resident, tolerably common, especially about Rea-burn Marsh in August and September (Hine). In great numbers at Shoal Lake, nesting among the reeds (D. Gunn). Red River Valley: Summer resident; common (Hunter). I have seen several specimens that were taken near the southeast end of Lake Manitoba; have never seen any on the Big Plain (Thompson). Shell River: 1885, first seen, one, on May 16; a transient visitant; not breeding here (Calcutt). I never met with it in six years of observing near the Red and Assiniboine Rivers (Nash).

I may here observe that great numbers of Night Herons breed here. They fix their nests to the reeds 8 or 9 inches above the water and deposit in each 4 or 5 roundish blue eggs. I think this is the only place in Rupert's Land where this species is found. We gave them the "go-by" last summer. The Indians call them Kitché geskman, *i. e.*, big king-fisher. (D. Gunn.)

58. *Grus americana*. Whooping Crane. Flying Sheep.

Tolerably common migrant and rare summer resident; frequent in Mouse River country in August, September, and October (Coues). Winnipeg: Summer resident; tolerably common (Hine). Oak Point: 1884, arrived May 1, 1885; first seen, three, on April 15; next seen on April 17; is common and breeds here (Small). Rare summer resident near Westbourne, arriving in April; seen all summer (Nash). Carberry: In migrations only; rare; have seen specimens from Shoal Lake, where it is said to breed (Thompson). Breeding in the marshes between Moose Mountain and the Pipestone (Macoun). Shell River: 1885, first seen, two, on April 30; next seen, a pair, on May 3; a transient visitant, passing north and not breeding (Calcutt). White Sand River (Christy). Qu'Appelle: Transient, passing over; April 28 to May 1 (Guernsey).

On April 19, 1882, saw two Whooping Cranes; the residents call them "Flying Sheep." They flew at a great height and were loudly croaking.

This beautiful bird is common in the Qu'Appelle Valley and in the Touchwood Hill range. It is a dangerous antagonist when wounded, striking with unerring aim and great force with its powerful bill. When the bird is wounded, the best way to avoid its attacks is to present the muzzle of the gun as it approaches; it will fix its bill in the barrel, and may then be destroyed without danger. Instances have been known of this bird driving its bill deep into the bowels of a hunter when not successful in warding off its blow. (Hine.)

59. *Grus mexicana*. Sandhill Crane.

Tolerably common summer resident; common along the boundary after leaving Pembina; breeding (Coues). Winnipeg: Summer resident; tolerably common (Hine). Dufferin: Arrives between April 25

and 30 (Dawson). Swamp Island: 1885, first seen, one, on June 10; rare and does not breed here; in fall, last seen September 7; 1886, first seen, two, on May 1; bulk arrived May 3 (Plunkett). Norway House (Bell, 1880). Oak Point: 1884, arrived April 19, 1885; first seen, two, on April 15; next seen on April 16; is common and breeds here (Small). Portage la Prairie: Tolerably common summer resident; breeds near here; arrives in April; first seen in 1884, April 21 (Nash). Carberry: Common; in migration, a few breed; also at Fingerboard, Shoal Lake, west, and Russell (Thompson). Assiniboine, near the White Sand, and at the mouth of the Shell, 1881; also, saw young ones near Moose Mountain, June, 1880 (Macoun). Two Rivers: 1885, first seen, two, on April 16; next seen, one, on April 19; became common April 23; is pretty common here and breeds (Criddle). Dalton: 1889, first seen, one, on April 12; next seen on April 13, when it became common (Youmans). Shell River: 1885, first seen, two, on April 19; seen every day afterwards; is common all summer and breeds here (Calcutt). White Sand River in May (Christy). Qu'Appelle: Transient; passing over, April 28 to May 1 (Guernsey). Trout Lake Station (Murray).

The first intimation that we usually have of the advent of the crane is the loud trumpeting or croaking that seems to shake the air for miles. But soon we begin to see the birds themselves, usually in pairs, even at this early season. Their food now is chiefly rosehips, and as they stalk over the bare plains gathering this manna of the feathered race, ample opportunity is offered for observation. At first one sees little to note beyond their excessive wariness, but as the warmer weather quickens their feeling, these majestic stalkers, these stately trumpeters, may often be seen so far forgetting their dignity as to wheel about and dance, flapping their wings and shouting as they "honor their partners," and in various ways contrive to exhibit an extraordinary combination of awkwardness and agility. This dance is no doubt one of the courting maneuvers, for I have observed it only during the pairing season.

It has been asked if these cranes breed in communities. To this I reply, I never saw anything to lead me to such a conclusion; all cases of their nesting that have come under my notice were those of isolated pairs.

The localities they select are generally damp meadows, not necessarily near the sand hills, the chiefly desired surroundings being rank grass wherein to forage, and scrubby or undulating land for cover.

When first they enter the wide world the two or three young ones are provided with a coat of reddish yellow down and an apparently superfluous length of limb. I perceive by reference to authorities, that the cranes are "*præcoces*," which being interpreted meaneth "they are clothed and can run and feed themselves as soon as hatched." Not having seen the young cranes at this interesting period, I can not gain-say the above statement; but know that a young one taken at the end

of June, and evidently 2 or 3 weeks old, made such a poor attempt at walking that he reflected but little credit on the noble order of *præcoces* to which his family belongs. And yet I must admit that when I first came on him he ran with very fair speed, and as his parents contrived to monopolize my attention for a time he escaped into the scrub, but later on was found squatting as still as death. He looked then deceptively like a red rabbit or a small fox. On being touched he sprang up uttering a gentle "peeping" which contrasted strangely with the strong croaks of his parents. He ran for a few yards with the grace and celerity of a Cochin fowl, but soon weakened and was obliged to sit on his heels.

I took him home and found that he spent fully half his time in this elegant position, and that, moreover, although he ate well and seemed in good health, he was scarcely able to stand erect excepting in the heat of the day, and when he attempted to rise he was almost sure to fall once or twice through his neck getting entangled with his shanks in a most unpræcocial manner; nevertheless, he grew and fledged and became quite tame. Then came two other pets to share the building wherein he had so long dwelt alone; they were a Peregrine Falcon and a Swainson's Buzzard. For a time all went well; the crane seemed to have strength enough and beak enough to take care of himself. Then I found out that he would even share the Falcon's food, so I offered him a sparrow; he seized it savagely and, uttering a peculiar harsh note, pinned it to the ground with his bayonet-like bill, then stabbed it again and again, and at last, having reduced it to a shapeless mass, he swallowed it. So that, although I have found only berries, grain, grass, and insects in the gizzards of old ones so far, I think it is likely that they will also eat frogs, mice, or small birds.

How it came about I never could tell, but one morning after a storm I found the peregrine sitting on the dead body of the crane; I did not at once remove it, and when I came again the two bandits had nearly eaten my gentle pet.

Several of the neighbors also have tried to rear young cranes and almost always with success and satisfaction, for, although it is difficult to keep them over winter, they become so tame and are so interesting during their stay that their owners feel amply rewarded for what little trouble they have taken with them. As a game bird I am inclined to place the present species first on the Manitoban list, as the White Crane and the swans are too rare for insertion on a list of species that the sportsman may pursue with regularity and success. An average specimen weighs about $9\frac{3}{4}$ or 10 pounds, and the quality of the flesh is unsurpassed by that of any of our ordinary birds unless it be the partridge. I should strongly advocate the protection of this bird by the game law were it not that it is so thoroughly well able to take care of itself that legislation in its favor seems altogether unnecessary.

The young cranes are apparently strong on the wing in August, for

at this time small bands of the species may be seen sailing high over the prairie, apparently strengthening their wings before they are compelled to journey southward for the season. As September draws nigh their numbers are increased, and the long array of the grand birds present a most imposing spectacle as in serpentine lines they float away after the sun.

60. *Rallus elegans*. King Rail.

Mr. Hine claims to have seen this near Winnipeg. At Carberry I once got a flying glimpse of what I took for this bird, but it was 30 yards away, and I failed to get either a second glimpse or a shot at it (Thompson).

61. *Rallus virginianus*. Virginia Rail.

Winnipeg: Common summer resident (Hine). ? Nest found at Carberry (Thompson).

The fine specimen of this bird in Manitoba Museum, taken at Reburn, where, Mr. Hine says, it is plentiful. It is, no doubt, more common in this country than is generally supposed; for, as Dr. Coues remarks, "their habit of skulking and hiding in the most inaccessible places they frequent, renders them difficult of observation, and they are usually considered rarer than they really are." The call of this species is rendered "*crik-cuk-rik-k-k-k*." It is said to be partially nocturnal.

A nest was brought to me from a slough near Carberry, July 30, 1884. It was found in a tussock of coarse grass, and was built of dry stems of the same; the eggs, eight in number, were quite fresh, and differed from those of the Carolina Rail only in being of a lighter color, and with reddish instead of umber spots, and chiefly about the large end; one was $1\frac{1}{4}$ by $\frac{15}{16}$, the others similar. The nest was of rushes and built precisely like that of the Carolina bird, but it was situated rather in a damp meadow than in a marsh. I did not see the bird, but have little doubt that it was the present species.

Mr. Nash sends the following note: "It haunts low ground like the rest of the order, but, so far as I have seen, they never go into deep-water marshes; in fact, they keep where there are bushes and low trees—alders, willows, and the like; and, when flushed, instead of taking to the rushes, they invariably fly in amongst the bushes."

62. *Porzana carolina*. Sora. Common Rail.

Common summer resident of all marshes. In September along Mouse River, at the boundary, appeared to be rather common (Coues). Winnipeg: Summer resident; abundant (Hine). Red River (Brewer). York Factory (Bell). Portage la Prairie: Very abundant summer resident; arrives about the middle of May; leaves about the end of September (Nash). Carberry: Abundant summer resident; breeding; and in the

country from Fingerboard to Birtle, nesting; very abundant; breeding in Duck Mountain, June, 1884 (Thompson). Shell River: 1885, first seen, two, on May 12; is common all summer and breeds here (Calcutt). Severn House (Murray).

June 28, 1882, at Rapid City Trail near Fingerboard, found the nest of a Sora. It contained fourteen eggs, which were within a few days of being hatched. The nest was placed in a bed of rushes, about 10 feet from the water, and was built of dry stalks of reeds, etc. The eggs were placed in two tiers, one on the other, as the nest was but 4 inches across. The question naturally suggests itself, however, how does this indefatigable little ovipositor contrive to warm the whole of this large clutch under her own little bosom and wings?

Late in the autumn, just before migrating, this bird develops startling powers of flight, though I am inclined to believe it does not rely entirely on its wings in its travels to and from its winter quarters, for just about the time of departure it may be found in most unlikely places; and it is just possible that when so found it may have been traveling southwards on foot. (Nash, in MSS.)

63. *Porzana noveboracensis*. Yellow Rail. Water Sparrow.

Summer resident. Winnipeg: Summer resident; tolerably common (Hine). Fort George (Bell). Hudson's Bay (Hutchins). In a marsh near Fort Pelly I saw a few that I took to be this species; they would fly and drop in the sedge; did not collect any (Macoun). At Carberry there is a small rail that is very common, but whether this or *P. jamai-censis* I can not be sure (Thompson).

On April 29, 1882, in the evening, while walking in the moonlight, by the slough, with W. Brodie, we heard a peculiar "tap-tap-tap"-ing that seemed to come from something in the near sedge. When we described the sound afterwards, at the house, old residents said it must have been a Stake-driver.

(Since writing the above I have become quite familiar with the Stake-driver, or bittern, and know now that the tapping was certainly not produced by it. This peculiar sound is a characteristic one of Manitoban marshes, and, unless it is the sound ascribed by Hutchins to the Yellow Rail, and described as resembling the striking of a flint and steel, I am at a loss to account for it.)

On August 3, 1883, a specimen of a little dark rail was brought to me. I put it, along with two young Killdeer Plovers, into a pen, wherein was already a Brahma hen with a large brood of young prairie chickens. As soon as the hen descried the strangers she made a dash and cruelly ill-treated one of the gentle killdeers before I could interfere; then she saw the rail gliding through the grass and ran towards it with murder in her eye and fight in every feather. But the rail ran to meet her. Both flew up together—the diminutive rail and the vast Brahma hen. The rail rose high enough to give the hen one peck on the head with his beak, and immediately a change took place. The hen straightened

her feathers, became a "peace-at-any-price" partisan, and never after took the slightest notice of the tiny Porzana. It finally escaped through a hole less than an inch across. It was almost impossible to hold it in the hand, so great was its power of forcing its body through the smallest opening.

This rail I took for *Porzana jamaicensis*, but had delayed making a careful diagnosis to a more convenient season, which never came, for the bird disappeared on the first night of its captivity; so that I do not consider the identification at all safe. It may have been *P. noveboracensis*. One is as likely as the other, and I believe both will yet be found in the province. Certain it is that a little rail, other than the Carolina, is often flushed in the rushes, and flies with its legs dangling; never, however, for any great distance; generally, it merely dashes out of the sedge at one place and along a few yards to drop into another. Its diminutive size and aquatic habits have, in some localities, procured for it the name of Water Sparrow.

64. *Fulica americana*. American Coot.

Common summer resident; extremely abundant along the line from Pembina to the Rockies; breeding (Cones). Dufferin: Arrived between April 25 and 30 (Dawson). Winnipeg: Summer resident; abundant (Hine). Oak Point: Arrived May 9 (Small). Lake Manitoba (Brewer). Portage la Prairie: Very abundant summer resident, arriving in May, departing early in October; first seen in 1884, May 6 (Nash). Carberry: Summer resident; not common; plain south of Souris River; Minnedosa, common; Portage la Prairie, abundant in fall (Thompson). Abundant on all pools of fresh water in the prairie region, with grebes; not common in the forest region (Macoun). Dalton: 1889, first seen, eight, on April 18; next seen on April 21, which was also last seen; common, but not breeding (Youmans). Shell River: 1885, first seen, a pair, on May 12; afterwards seen every day all summer; is common; it breeds here; nest found with thirteen eggs (Calcutt). Qu'Appelle: Common summer resident; breeds; arrived May 6 (Guernsey).

On June 25, 1884, in a pond 10 miles west of Minnedosa, I saw four coots engaged in a curious set-to. They might have been fighting, or merely playing. They were close together, and all were splashing the water about, flapping their wings and bobbing up and down; they faced each other, but never seemed to strike each other, so far as I could see. I have several times seen this performance in the spring time.

The migration of the coot is very singular; late in the autumn I have seen these birds in countless numbers in the marshes at the south end of Lake Manitoba; for a few days previous to their going they keep up a ceaseless chatter and row, apparently discussing the propriety of leaving. On my going out some morning after this has gone on, not a single solitary coot is to be seen, except perhaps a wounded one that can not fly; they are unlike other birds, only migrating at night. I have never seen a flock of them in the daytime. These marshes of Lake Manitoba appear quite

solitary after these birds are gone, although there are thousands of other birds there. (R. H. Hunter in MSS.)

Arrives early in spring, as soon as the ice goes out, and remains until it freezes up entirely, often staying about open holes in the ice until the last drop of water has disappeared from sight. On its first arrival in the spring and throughout the breeding season its habits much resemble those of the true rails, and it is continually skulking and hiding among the rank vegetation in which it resides; but after the young have acquired strength and confidence in themselves a change takes place in their habits. They now gather into large flocks (several times I have seen over a hundred together) and betake themselves to the open water, where they may be seen swimming and diving, like a lot of blue-bills or red-heads, rather than rails; at this time they will, if approached, rise high in the air and make long flights over and around the marsh they inhabit; this they will do all day long, but at dark they retire into the high rushes to roost. All the other birds of this family I have found at times in dry grassy meadows or amongst low scrub, but the coot never seems to leave the more watery parts of the marsh. (Nash in MSS.)

65. *Phalaropus lobatus*. Northern Phalarope.

Irregular migrant. Winnipeg: Transient visitor; not common; appears in spring and fall about Reaburn marshes (Hine). Common autumn visitor to Portage la Prairie, and very abundant at the prairie sloughs near Winnipeg, where I saw immense flocks of them in August and September, 1886 (Nash).

66. *Phalaropus tricolor*. Wilson's Phalarope.

Summer resident; breeds throughout the country from Red River to the Rockies along the line; in suitable places common, though never observed in large numbers at any one place (Coues). Winnipeg: Common on the prairies in spring; breeding at Seaborn and Lake Winnipeg (Hine). Eighteen miles south of Brandon, a pair observed June 15, 1882 (Wood). Breeding around ponds at Moose Mountain, July 24, 1880 (Macoun). "*P. lobatus* Ord," Severn House (Murray).

June 15, 1887, 18 miles south of Brandon, saw a splendid pair of (Wilson's) Phalarope swimming on a pool only a few yards away; one of them kept rising and flying around, and I could distinguish the beautiful red and black neck quite plainly. (Wood).

67. *Recurvirostra americana*. American Avocet.

A western bird, very rare in Manitoba. Winnipeg: Rare; straggler along the Red River (Hine). Have killed the bird along the Souris, southwest of Plum Creek; in the museum of the Geological Survey at Ottawa is a specimen of the Avocet, marked from Manitoba (R. H. Hunter). (Professor Macoun tells me that the locality of this specimen is doubtful.—E. E. T.) Very abundant around saline ponds and lakes throughout the Northwest; shot at the base of the Coteau du Missouri, July 25, 1880 (Macoun). Qu'Appelle: Occasionally here; plentiful on the alkali ponds west (Guernsey).

68. *Philohela minor*. American Woodcock.

Very rare summer resident. Winnipeg: rare; only two pairs killed, and under a dozen birds seen altogether in 4 years (Hine). I saw one specimen of the woodcock at York Factory, in the end of August last. This bird is not uncommon in Manitoba, although the fact is not generally known (Bell, 1880). Oak Point: 1885, first seen May 13; rare; one was shot (Small). Rare summer resident; I shot ten birds in 5 years near Portage la Prairie; in 1886 I found a pair breeding near Winnipeg; arrive about the end of April, depart in September (Nash).

69. *Gallinago delicata*. Wilson's Snipe. Common Snipe.

Abundant summer resident of sloughs and swamps; abundant at Mouse River, on the boundary, in September (Coues). Dufferin: Arrived between April 15 and 20 (Dawson). Winnipeg: Summer resident; abundant (Hine). Red River Settlements, April 29 (Blakiston). Snipe found above Split Lake, and in many places along Nelson River; common in Manitoba (Bell). Ossewa: Common; breeding; 1885, first seen, three, on May 5; next seen May 8, when it became common (Wagner). Oak Point: 1885, first seen, one, on April 26; next seen, April 26; is common here (Small). Portage la Prairie: Common summer resident; abundant in spring and autumn migrations; I have, in August, frequently seen wisps containing from twenty to thirty birds; arrives in April; departs in October (Nash). Common all along the route of 1881; specimens shot at Swan Lake, Red Deer Lake, and Fort Pelly (Macoun). Carberry: Abundant; summer resident; breeding; Boggy Creek and various parts of the Big Plain; Rat Portage (Thompson). Two Rivers: 1885, first seen, April 6; somewhat rare; I believe it breeds here (Criddle). Dalton: 1889, first seen, one, on April 8; next seen, on April 12, when it became common; breeds here (Youmans). Shell River: 1885, first seen, one, on May 4; next seen, three, on May 8; a transient visitor, passing north; not remaining to breed (Cèlcutt). Qu'Appelle: Common summer resident; breeds; arrives April 20 (Guernsey).

Snipe are now (May 5, 1882) quite numerous; they frequent the damp rather than wet places. Their principal amusement on cloudy days seems to be dashing across the sky at a height of 200 or 300 feet and uttering a loud vibratory note, which is repeated, with lessening intervals, a dozen or more times; during the production of the sound the bird's wings seem to be rigidly set, but the tips appear to vibrate, and, at the same time, the course is obliquely downwards. As soon as the serenade is over the snipe wheels about, regains his elevation, and repeats the performance indefinitely. Having vented the feelings which prompted these actions, he descends to a much lower level by one or two long slanting gyrations, and then regains the earth by half closing his wings and dropping downwards into the grass.

The performance usually takes place in dull weather or in twilight. After it is over, I have often induced him to repeat it by marking him down and then springing him; he generally rises, uttering a sort of "screep," zigzags for a few yards, circles round the horizon in one or two sweeping gyrations, and either pitches down again to the grass or continues to ascend, and then repeats his song.

The next day one of the snipe's notes seems not unlike the "*tow, tow, tow*," of a stray turkey, but in a higher key.

About a week after arriving in its former haunts this well-known species begins to manifest its presence by uttering the remarkable pairing serenade for which several of the scolopacine birds are noted. When prompted to this peculiar performance the snipe—the male only, I suppose—rises suddenly from the bog where he has been feeding, and where his usual note is a "squeak! squeak!" and now, just after rising on his long, swift wings, this "squeak" is generally repeated a number of times. Immediately after taking wing he circles all around the marsh, then rises, silently, higher and higher, still circling, until, having reached an elevation of several hundred feet, he gathers his strength and goes whizzing across the sky, his tail spread to its utmost extent and wings vibrating with great rapidity, while a loud, sharp boom, repeated quickly twenty or thirty times, is heard as long as this career is continued. While thus engaged the course of the bird has been straight and slightly downward, and as soon as it is ended he remounts and dashes across again with the same resounding accompaniment. This he will keep up for half an hour at a time. Thus having expended his exuberant energy, he wheels lower and drops into the slough to receive the congratulations of the only spectator whose attention was specially courted.

This booming or whirring may be a product of the voice, or it may be caused by the wings, which appear to vibrate simultaneously with the production of the sounds, the quality of which is very nearly the same as that of the boom of the night hawk.

The favorite haunts of this bird are the open grassy sloughs or bogs which intersect the country. Here it finds in abundance the smaller insects which constitute its food, and here it makes its nest and rears its young. The position of the only nest of this species that I found was in a slightly-elevated tussock or sod in the middle of a wide muskeg. The nest consisted of a slight hollow, with a few straws for lining, and was raised only about 3 inches above the water. This was in the third week of July, and by the 27th of the month the four young ones were hatched and immediately left the nest, to lead a roving life with their mother among the grassy bottoms and the muskegs, rich with an infinitude of insect life.

70. *Macrorhamphus scolopaceus*. Long-billed Dowitcher, or Red-breasted Snipe.

Common, chiefly as a migrant in the western part of the province; Mouse River, at the boundary, possibly breeding; extremely numerous in September (Coues). Red River Valley: Summer resident; common west of Brandon; I have shot eighty in four discharges of a gun; are never seen in eastern Manitoba (Hunter). Winnipeg: Very rare; secured three or four near Reaburn; observed only in August and September (Hine). Very abundant at Swan Lake House and Red Deer Lake, July and August, 1881 (Macoun).

71. *Micropalama himantopus*. Stilt Sandpiper.

One specimen procured on the plain north of Qu'Appelle September 16, 1880 (Macoun). (This is just west of the province.) Have seen it in August and September on the Assiniboine, near Portage la Prairie, singly or in pairs; rare (Nash).

72. *Tringa canutus*. Knot. Robin Snipe.

Migrant. Winnipeg: Tolerably common in the migrations (Hine). I have never seen the Knot along Red River, but have seen large flocks of the species west of Brandon (R. H. Hunter).

73. *Tringa maculata*. Pectoral Sandpiper.

Migrant, chiefly in fall; common in fall migration along line at Turtle Mountain (Coues). Winnipeg: Rare; migrant (Hine). Portage la Prairie: Common in the autumn, frequenting the grassy marshes (Nash). Abundant along the route of 1881, also on the Great Plains and Northwest (Macoun). Moosejaw (west of Manitoba), July 7 (Miller Christy).

74. *Tringa fuscicollis*. White-rumped Sandpiper.

Migrant; not common. Portage la Prairie: Have occasionally taken it in autumn and more rarely in spring (Nash). Shoal Lake (south slope of Riding Mountain) and on Duck Mountain, June, 1884 (Thompson).

June 4, 1884, near Shoal Lake, saw a large flock, fifty or sixty; of White-rumped Sandpipers as they flew along the shores of a little pond; they performed so exactly the same evolutions in close column that the whole flock was entirely dark and silvery, according as they turned their backs or their breasts to me. Five specimens collected, two ♂ and three ♀; all showed sexual organs enlarged; all very fat; all had stomachs filled with aquatic insects; one had a very large larva.

75. *Tringa bairdii*. Baird's Sandpiper.

Fall migrant; not very common; in fall migration one of the most abundant sandpipers; along Mouse River and westward along the line of the Rockies (Coues). Have seen it in the autumn, near Portage

la Prairie (Nash). Saw a number on a salt marsh on Red Deer River, July 23, 1881 (Macoun). Carberry, August 21, 1884: Now common about the lakes in company with the two Yellow-legs, but not in flocks (Thompson).

76. *Tringa minutilla*. Least Sandpiper.

Somewhat common as a migrant; may breed. Turtle Mountain, July 30: Should not be surprised if it bred in the vicinity (Coues). Winnipeg: Tolerably common summer migrant (Hine). Shoal Lake, May 15, 16, 17, 1887 (Christy). Portage la Prairie: Very abundant, appearing in large flocks on the sand bars in the Assiniboine River and about the prairie sloughs in August (Nash). Shot on Red Deer River, July 23, 1880 (Macoun).

77. *Tringa alpina pacifica*. Red-backed Sandpiper. Blackheart.

Migrant. Winnipeg: Transient visitor; tolerably common along the river (Hine). Portage la Prairie: Tolerably common during the fall migrations (Nash). Severn House (Murray).

78. *Ereunetes pusillus*. Semipalmated Sandpiper.

A migrant along Red River, Mouse River, and along the boundary at various points during August (Coues). Tolerably common along Red River in the migration, frequenting the wet prairies near Winnipeg (Hine). Portage la Prairie: Abundant in Assiniboine in the autumn; appearing early in August (Nash). Shot on the Red Deer River July 23, 1881 (Macoun).

79. *Calidris arenaria*. Sanderling.

Migrant; numerous about Lake Winnipeg, June (Kennicott). Shot five out of a flock at Oak Lake, a prairie slough, a few miles north of Portage la Prairie, August 1, 1884 (Nash). Abundant on the west shore of Lake Manitoba, June 12, 1881 (Macoun).

80. *Limosa fedoa*. Marbled Godwit.

Tolerably common summer resident. Pembina, June 30, 1873, nesting (Coues). Winnipeg: Summer resident, tolerably common (Hine). Red River Valley: Summer resident; common in Western Manitoba (Hunter). Plum Creek: Breeding, 1882, June 20 (Wood). Plains near Long River and South of Souris, May; tolerably common (Thompson). Qu'Appelle: Common summer resident; breeds; arrives May 10 (Guernsey). Hudson's Bay (Murray).

May 18, 1882, at Long River, north-east slope of Turtle Mountain, C. T. shot a fine ♀ Marbled Godwit from the wagon; feet, black; gizzard filled with shells and insects. They are somewhat common on

these wide, wet plains, but all those noted have been solitary individuals. Their large size, reddish color, and long straight bills distinguish them at a great distance.

81. *Limosa hæmastica*. Hudsonian Godwit.

Rare migrant. Winnipeg: Transient visitor; rare (Hine). Severn House (Murray).

82. *Totanus melanoleucus*. Greater Yellow-legs.

Abundant; migrant spring, late summer, and fall; very abundant in August and September at the boundary along Mouse river (Coues). Dufferin: Arrived between April 15 and 20 (Dawson). Winnipeg: Abundant in summer migration (Hine). Norway House (Bell). Portage la Prairie: Abundant in spring, arriving in April, usually in pairs; about the first of August they reappear in small flocks about the rivers and open prairie sloughs, where they feed on small frogs; depart late in October; the last flock I saw in 1884 were flying south in a snow storm on 21st of October (Nash). Very abundant at Red Deer river and on the Assiniboine; about all ponds in the fall of 1881 (Macoun). Carberry: Abundant; migrant in spring and in late summer (Thompson). Shell River: 1885, first seen, seven, on April 24, transient visitor; passing north, and not remaining any time or breeding (Calcutt). Qu'Appelle: Common migrant, May 5 (Guernsey). Severn House (Murray). Very common from the sea to Lake Winnipeg at the season (Blakiston).

August 21, 1884: Greater Yellow-legs are still very common about the weedy lakes. They come down from the north about the 1st of August, and are to be seen usually on the points of land that run out into the ponds; as they stand motionless on the promontories they look twice as large as they really are. They are more shy and less active than their minor brethren, for they usually stand in a dignified way until fired at or forced to fly, seldom running in the sprightly fashion of the Lesser Yellow-leg. They differ also in their food, for I have found the larger species with numerous small fish in their gullets, which is unusual for a Tattler. The members of this species raise their voice in a great outcry each time a gun is fired.

83. *Totanus flavipes*. Yellow-legs.

Common migrant all over; abundant throughout the Winnipegosis region; Nelson River; chiefly noted in Assiniboine Valley about August 15; common; spring, late summer, and autumn migrant; very abundant in August and September; along the boundary at Turtle Mountain and Mouse River (Coues). Winnipeg: Abundant (Hine). Portage la Prairie: This species arrives later than the last (Greater Yellow legs), not usually appearing before the 12th of May; they return about the first of August in flocks, and depart at the end of September, my latest record being October 1st, 1886, a single bird, near the Red River

(Nash). Carberry: Common migrant in August (Thompson); abundant about all pools in the fall, along the route of 1881 (Macoun). Shell river: 1885, first seen, three, on April 24; transient visitor, only passing north, and not remaining any time or breeding (Calcutt). Qu'Appelle: Common migrant; May 5 (Guernsey). Severn House (Murray).

84. *Totanus solitarius*. Solitary Sandpiper.

Chiefly in migrations; probably breeding; in abundance in autumn migration, Turtle Mountain, and Mouse River at the boundary (Coues). Winnipeg: Summer resident; abundant (Hine). Portage la Prairie: Tolerably common, and I think that some breed, though I have not found the nest; arrives about May 15; reappears about 1st August; departs in September (Nash). Frequent throughout the Winnipegosis region along the route of 1881; breeding, for young were observed July 20, feathered, but with some down yet (Macoun). Carberry and Portage la Prairie; in late summer migration (Thompson).

September 16, 1884, at Portage la Prairie, shot a solitary sandpiper.

On July 10, 1884, I shot a specimen of the solitary sandpiper (*Rhyacophilus solitarius*) at Maple Creek, 597 miles west of Winnipeg; it was doubtless breeding. In the dry bed of the creek I also caught a nestling bird, which was probably of this species. (Christy.)

85. *Symphemia semipalmata*. Willet.

Tolerably common summer resident in the south and west, at various points along the line from Red River to the Rockies (Coues). Souris Plain, near Turtle Mountain: Nesting, near Shoal Lake in June (Thompson). Common around saline ponds on the western plain and on the east side of Moose Mountain, July 29, 1880 (Macoun).

On May 23, 1883, on the Alkali Plain, north of Turtle Mountain land office, started a willet from her nest, which was placed in a slight hollow, shaded on one side by the skull of a buffalo and on the other by a tuft of grass. It contained four eggs, each of which measured $2\frac{1}{2}$ by $1\frac{1}{2}$ inches, ground color, dark olive brown, with heavy, round dark spots of brown and purple, evenly distributed, without any approach to a ring about the large end.

86. *Bartramia longicauda*. Bartramian Sandpiper. Prairie Plover. Quail.

Abundant summer resident on the dry prairies; extremely abundant over the Red River prairies, along the boundary, Turtle Mountain, Mouse River; breeding (Coues). Winnipeg: Summer resident; common (Hine). Breeding at Selkirk Settlement (D. Gunn). Portage la Prairie: Abundant summer resident from early in May to about August 10 (Nash). Abundant in the prairies from Grand Valley and westward; not seen in the forest region (Macoun). Carberry: Abundant summer resident; breeding; in all the prairie regions to Brandon, and south to Turtle Mountain, also from Carberry northwestward to Fort Ellice

(Thompson). Two Rivers: 1885, first seen, one, on May 3; next seen, several, on May 4; became common May 5; breeds here (Criddle). Shell River: 1885, first seen, two, on May 4; afterwards seen every day; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives May 12 (Guernsey).

May 6, 1882: For some days back I have heard a loud rattling whistle that seems to come from the skies, and sometimes I have seen the bird that produces it sailing at a great height. Occasionally I have observed it sail downwards at an angle of 45 degrees and settle on the fence or on the prairie. To-day at noon I shot one of these birds as it was perched on a fence stake. It first alighted on the barn, where C. T. fired at it, but it flew off and alighted on the fence where I winged it. It did not attempt to escape, but lay on its back with its legs drawn up. I found it to be the upland plover, or quail, as the residents call it. It was a male, length $11\frac{1}{2}$, extension $20\frac{1}{2}$; stomach contained insects and two rose-pip stones.

May 11: Single quailies very numerous now; they seem to sail downward out of the very sky, uttering their mournful whistle, like "*rrrrrrr-pee-pee-oooo!*" as they sail down on the prairie, where they stand for a few seconds, like the statue of an angel, with their wings raised aloft, doubtless to show the beautifully barred under side, then deliberately folding them they nod and step forward and nod again at each step, and pick up the unfortunate early flies, and stop occasionally to reiterate the mournful whistle and thereby conjure out of the very clouds some comrade who also sweeps downward, whistles, alights, strikes the vainglorious attitude, then joins in the varied pursuits of love, music, and beetles.

May 4, 1883: Quailies noted. A. S. T. May 11, quailies very numerous now.

On June 6, 1883, while crossing the prairie near the house, I flushed a Quail from her nest almost under my feet; she fluttered a few yards forward and then lay flat on the prairie, beating her wings on the ground and uttering such heart-broken cries that I could not but leave her in peace. The nest contained three eggs.

June 15. I saw a curious sight on some newly broken prairie. A Quail had sprung from her nest just under the feet of the plough-horses; the man had stopped them, removed the four eggs the nest contained, ploughed on, and then, after replacing the square foot of sod the bird had nested in, restored the eggs to their place and left them. Very soon the mother bird found courage to return and resume her duties, and when I saw her, she was sitting contentedly on her eggs in this tiny green patch surrounded by acres of level black earth.

June 4, 1884. In this day's drive saw no pairs of Quailies, but observed seven solitary birds. During the last week of May the species was always seen in pairs, and it was this that led me to count. The change noted to-day is, no doubt, due to the fact that the honey-moon

is over and the laying season commenced. The egg of this species is actually larger than that of a prairie chicken, although the quail weighs but 4 ounces, and the chicken nearly ten times as much.

During the summer no bird is more familiar on the Manitoban prairies than the Upland Plover or Bartram's Sandpiper (*Bartramia longicauda*), commonly there known as the "Quail," from its note. Surely no bird ever differed more completely from the generality of its relatives than this! It is a Sandpiper which does not appear to frequent marshes, which breeds habitually on the dry open prairies, and which is frequently to be seen perched among the branches of trees. Its tameness is excessive. Often when driving over the prairie I have seen it remain within 3 yards of the passing vehicle without the slightest concern. When on the wing, it offers a shot so temptingly easy that few can resist. Its note is a highly remarkable one, not easily forgotten when once heard. Dr. Coues well describes it as a "long-drawn, soft, mellow whistle, of a peculiarly clear, resonant quality." It breeds abundantly on the open prairie, and I have several times caught the young in down. The majority left Manitoba towards the latter end of August, but I was several times surprised at hearing or seeing a belated pair until quite late in September. (Christy.)

This species is an abundant summer resident on all the dry prairies near Portage la Prairie, arriving early in May; at this time they are very tame, and may frequently be seen perching on the fences, and I once saw one make a ludicrous attempt to settle himself on the glass insulator on top of a telegraph pole. About the 1st of August they desert this prairie and betake themselves to the broken land in small flocks. They are then very wild. By the 10th of the month they have all left; though on August 29, 1884, I saw a single bird flying over. Not observed in the vicinity of Winnipeg (Nash in MSS.).

87. Tryngites subruficollis. Buff-breasted Sandpiper.

Winnipeg: Transient visitor; rare; in migration along Red River (Hine).

88. Actitis macularia. Spotted Sandpiper.

Common summer resident along streams; throughout the region from Pembina to Rockies along the boundary (Coues). Winnipeg: Summer resident; abundant; breeding (Hine). Norway House (Bell, 1880). Shoal Lake, May 15, 1887 (Christy). Oak Point: 1884, arrived April 22 (Small). Portage la Prairie: Abundant summer resident, arriving soon after May 1; departs at the end of September; the last seen by me was on the 24th of that month (Nash). Common; breeding along the route of 1880 and 1881; always seen in couples (Macoun). Portage la Prairie: July 22, 1884, saw young Peetweets running with the old ones along the banks of Owl Creek (Thompson).

89. Numenius longirostris. Long-billed Curlew.

Summer resident of the wet prairies; breeds in moderate numbers about Pembina (Coues). Winnipeg: Rare; transient; visitor (Hine). Rare spring and autumn visitor; saw five on Rat Creek, in the Westbourne marsh, October 8, 1884 (Nash). Frequent on the Souris plain, May, 1882, frequenting the wet prairie (Thompson).

90. *Charadrius squatarola*. Black-bellied Plover.

Spring migrant. Winnipeg: Fairly plentiful, frequenting fields or flying in large compact flocks with other waders; goes north to breed, but is back in numbers during the summer (Hine). Carberry: Spring migrant; saw flocks on the fields May 24, 1884, and on June 3, on Rapid City Trail; south slope of Riding Mountain, saw three; also a Gray Plover (Thompson). Dalton: 1889, first seen, about a hundred, on May 27; are common for a few days in spring (Youmans). Severn House (Murray).

91. *Charadrius dominicus*. American Golden Plover.

Common spring and fall migrant; very abundant along the Mouse River at the boundary, in late September (Coues). Winnipeg: Abundant; transient; visitant; arrives about the middle of May; goes north to breed; comes back in large flocks in August; affects burnt prairie and ploughed land (Hine). Portage la Prairie: Abundant spring and autumn visitor, occurring in large flocks; they frequent the prairie sloughs, the broken land, and are particularly partial to the burnt prairie; I have seen them in vast numbers following the fires; they will alight on the ground burnt over a few hours after the fire has passed; arrive in May, reappearing in August, and departing in October (Nash). One flock seen at Fort Pelly, September 18, 1881 (Macoun). Carberry: Common spring migrant; Long River; plain south of the Souris; north side of Turtle Mountain (Thompson). Shell River: 1885, fifty or more in flocks going north on May 26; transient; visitant only; not breeding (Calcutt). Qu'Appelle: Tolerably common migrant; May 20 (Guernsey). Trout Lake Station and Severn House (Murray).

92. *Ægialitis vocifera*. Killdeer.

Common summer resident; abundant throughout the summer in all suitable places, Pembina to the Rockies, along the line (Coues). Dufferin: Arrived between 15th and 20th of April, 1874 (Dawson). Winnipeg: Summer resident; plentiful; breeding (Hine). Oak Point: 1885, first seen, one, on April 17; next seen, one, on April 18; is common, and breeds (Small). Portage la Prairie: Abundant summer resident, arriving in April, departing at end of September (Nash). Abundant everywhere along the route, on Western plains, and especially on Winnipegosis, around the salt licks; shot at Manitoba House, June 16, 1881 (Macoun). Carberry: Latterly a summer resident, breeding about ponds, preferably with gravelly or sandy shores; near Brandon; near Long River; Silver Creek; near Rapid City (Thompson). Dalton: 1889, first seen, five, on April 8; next seen on April 12, when it became common; breeds here (Youmans). Brandon: Breeds; eggs taken second week in July, 1882 (Wood). Shell River: 1855, first seen, one, male, on April 6; is a common summer resident, and breeds here (Calcutt).

Qu'Appelle: Common summer resident; breeds; arrives April 17 (Guernsey).

July 7, 1882, at Silver Creek, saw a single downling Kildeer running on the trail just before the oxen; both its parents were flying about, uttering their loud laments and trying to decoy the young one aside, but could not get it out of the wagon rut into which it had fallen; it ran on straight, trying to keep ahead of the oxen, till I caught it. It was the most fawn-like thing I ever saw in feathers; its large lustrous eyes were turned on me with an expression of fearless innocence that was touching, and when I set the little ball of down at liberty on the prairie it walked gracefully away without betraying any consciousness of having been in the power of its worst enemy. It was apparently newly hatched, but the markings of its downy coat were similar to those of the adult birds, minus the orange.

93. *Ægialitis seimipalmata*. Semipalmated Plover. Ring Plover.

Rare migrant between Hudson Bay and Lake Winnipeg (Murray). Winnipeg. Summer resident; rare (Hine). Common at Lake Winnipeg in June (Kinnicott). Portage la Prairie: Very abundant in August, frequenting the sand-bars on the Assiniboine with the Least Sandpiper (Nash). Abundant with Kildeer, and evidently breeding, as I saw young with them at the salt springs on Red Deer River, July 22, 1881; at Lake Manitoba (Macoun). Brandon: One seen April 28, 1882, another May 25 (Wood). Trout Lake Station and Severn House; plentiful in Arctic America (Murray).

94. *Ægialitis meloda*. Piping Plover. Ring-neck.

Migrant; possibly breeds also. Winnipeg: Summer resident; tolerably common (Hine). Procured four specimens at Lake Winnipeg (D. Gunn). Portage la Prairie: Occurs in the migrations with the Semipalmated Plover (Nash). Shot migrating in company with Sanderlings on the shores of Lake Manitoba, June 12, 1881 (Macoun).

95. *Arenaria interpres*. Turnstone.

Migrant. Winnipeg: Rare, but occurs about the prairie ponds here, and on shore of Lake Winnipeg in pairs; apparently goes north to the large lakes to breed; returns about the middle of August (Hine). Lake Winnipeg (Brewer). Severn House (Murray).

96. *Dendragapus canadensis*. Spruce Partridge.

Resident in the spruce forests of the north and east; common. Winnipeg: Summer resident; abundant in spruce woods, but so tame and fearless that its pursuit can scarcely be called sport (Hine). A specimen in Smithsonian Institution from Red River Settlement (Blakiston). Does not occur in the immediate vicinity of Portage la Prairie or Winnipeg,

but I have seen numbers of them brought in to the game dealers from the woods about Lake Winnipeg, where it is resident (Nash). Swampy Island: 1885, first seen, flock of ten, on March 9; next seen March 11; always common and resident; very abundant October, November, and April; breeds here (Plunkett). Very numerous in the poplar woods to the north of Fort Pelly along Red Deer River, and at the sources of the Swan River, August, 1881 (Macoun). Rat Portage: One specimen taken by me October, 1886; I was informed that it is not uncommon here, though much less plentiful than the Birch Partridge or Bonasa (Thompson). Trout Lake (Murray). In great plenty near Cumberland House (Hearne, 1771).

October 16, 1886, Rat Portage: Shot a female Spruce Partridge to-day; length, $14\frac{1}{2}$; wing, 7; tail, $4\frac{1}{4}$; crop and gizzard filled with spruce leaves. This is the only specimen seen here, but at Port Arthur, October 8, I saw numbers exposed for sale in the shops; they were said to have been shot in the neighborhood.

97. Bonasa umbellus togata. Canadian Ruffed Grouse. Birch Partridge.

Tolerably common in the spruce woods of the east; specimens sent to Mr. Ridgway from the "Norwest Angle" near Rat Portage have by him been pronounced this variety; it is fairly plentiful there and known as the Birch Partridge; it is probable that all of this species found within the limits of the coniferous forest as indicated may be referred to the form of *togata*; therefore I assume that the following records belong here: "Puskee, Shoulder-knot Grouse;" this bird is an inhabitant of the southern parts of Hudson's Bay; feeds on birch buds (Hutchins, MSS. observations, Hudson Bay, 1782). Swan Lake (probably) (Macoun).

Referring to the Ruffed Grouse, the Sharptail, and the Wood or Spruce Partridge, Hearn says: "I have seen them in great plenty near Cumberland House;" and later, in writing of the drumming of the first: "I have frequently heard them make that noise near Cumberland House in the month of May, but it was always before sunrise and a little after sunset."

On October 11, 1886: At Rat Portage some Indians came to the door to-day with a lot of partridges to sell. These no doubt would have proved *togatus*, as they must have been taken in the neighborhood; several among them had red ruffs, showing that that variation is not confined to the subspecies *umbelloides*.

At Rat Portage, January 14, 1887, I received five partridges (var. *togatus*), shot in the woods just west of this point; four were males and measured $17\frac{1}{4}$, $19\frac{1}{8}$, 19, $18\frac{1}{4}$ in length; one doubtful was $19\frac{3}{4}$ long.

Carberry specimens of *umbellus* had been referred to the form *umbelloides* by Mr. Ridgway, and when he further decided my Rat Portage specimens to be *togatus*, there were not lacking those who ridiculed the idea of the two forms being typically represented within 200 miles

of each other; but a further consideration of the physical features of the country has shown the reasonableness of such occurrence, for the *togatus* birds were taken within the great coniferous forest which is its assigned locality, while the *umbelloides* examples were taken from the open aspen woods near the northeastern boundary of the dry region that is inhabited by the pale form of *umbellus*.

97a. *Bonasa umbellus umbelloides*. Partridge, or Gray Ruffed Grouse.

Common resident of the poplar woods in the west and south of the province. Specimens sent from Carberry to Mr. Ridgway prove to be of the variety *umbelloides*; therefore I assume that all those taken in the open and poplar woods are of this form.

Winnipeg: Permanent resident; common (Hine). Ossowa: Resident; breeding (Wagner). Specimen from Red River Settlement in Smithsonian Institution (Blakiston). Portage la Prairie: Abundant; resident in the woods, and frequently found in the bluffs on the prairie if they are of any extent (Nash). Heard drumming about Manitoba House, 1881; abundant in woods along Red Deer and Swan Rivers, 1881; Fort Ellice; Touchwood Hills and northern woods generally (Macoun). Carberry: Common, and resident in all woods; noted at south slope of Riding Mountain, Fort Ellice, west slope of Duck Mountain, and Portage la Prairie (Thompson). Qu'Appelle: Common; permanent resident; breeds (Guernsey).

On April 4, 1882, the snow was 3 to 4 feet deep everywhere. Went to the slough with W. Brodie. We saw several Ruffed Grouse and we each shot one.

Bonasa umbellus umbelloides, male; length $17\frac{1}{2}$, extension 21 inches. The pectinations or points of its snowshoe but about half a dozen on the outside of each outer toe; the middle claw of each foot rubbed down to a mere stump, the others normal; fine, full, black ruff. The bill presented an unusual feature, for when the mandibles were closed there still remained a wide opening right through the beak, near the tip, just behind the hook; this had the appearance of having been *worn* away, as no doubt it was in process of collecting the browse on which the species feed throughout the winter. Its crop was filled with various kinds of buds.

Second specimen, female; length $16\frac{1}{2}$, extension 22. Snowshoes or pectinations on the feet perfect; ruff insignificant; bill normal; crop full of browse.

April 10, the snow still deep in the woods, shot a Ruffed Grouse, male; length 17, extension 22. Tarsi feathered to the toes; claws blunt; pectinations of toes perfect; tail all gray without any brown at all, as also was the general plumage; ruffs very full; beak with the same remarkable subterminal opening as that already noted on April 4.

In the spruce bush on December 5, after sundown, as I walked near the camp, I noticed the marks in the snow where two Ruffed

Grouse had alighted, and then without running more than a few steps had dived into the drift. As I came nearer the birds sprang up through the powdery snow a few feet in advance of their entering places and I secured one of them. It was of the typical *umbelloides* form, with gray tail and plumage; its crop was filled with catkins (hazel?), equisetum tops, rose-hips, and various kinds of browse; probably birch preponderated.

It seems to be the normal habit of this bird to roost in a snow drift during the coldest weather. The wonderful non-conductivity of the snow is well known, but may be forcibly illustrated by the fact that although the thermometer registers 35° below zero, the 10 inches of snow which fell before the severe frost came, has effectually kept the wet earth in the woods from freezing, although the temperature has been at or below zero for over a week. In view of these facts it is easy to understand that the grouse in the snow drift are quite comfortable during the coldest nights. In general the bird will be found to run about before burrowing into the drift; each makes its own bed, usually 10 or 20 feet from its neighbor; they usually go down a foot or so and along 2 feet; they pass the whole night in one bed if undisturbed, as the large amount of dung left behind would indicate. They do not come out at the ingress, but burst through the roof of their cot at one side; they do not usually go straight ahead and out, because their breath during the whole night has been freezing into an icy wall just before their nostrils.

On December 7, in the spruce bush, shot two Ruffed Grouse this afternoon, about sunset. They were running about on a snowdrift, picking the buds off the projecting twigs of a shrub that I take to be the dwarf birch. One of them was in splendid bronze plumage, *i. e.*, with the ruffs and tail band of a rich copper color, and the other dark marking, glossed with the same. To-day the thermometer stood at 20° below zero.

On May 24, 1883, saw a partridge on his drum-log in the eastern woods. The log looked as though it had been used for several seasons, as it was much worn and a great quantity of dung was lying on each side of it.

On August 21, while crossing a part of the spruce bush, I heard the warning chuckle of a partridge to her brood. I pressed quickly forward and distinctly saw her sitting on a stump, 30 yards away. Fresh meat was desirable, and the young were well grown; so, hastily raising the gun, I fired, without the slightest effect on the gray still form on the stump, but at the shot the young ones rose with a whirr and scattered to the left. Then again I fired in haste at the form on the stump, this time with ball, and the only effect was to satisfy myself that I had been blazing away at an old knot. As I reloaded I walked towards this deceptive piece of wood, and it continued as rigid as any other stump until I was within 15 yards, when up it sprang and flew off in the woods in the opposite direction to that taken by the flock.

October 25: Birtle. During the last few days, while traveling on both banks of the Assiniboine, I have seen every shade of brown and gray partridges together in the same regions.

November 12: Ground covered with snow; hard frost; in spruce bush with J. Duff on a deer hunt; saw three partridges roosting in an open poplar, about dusk; shot two of them. I can not understand these birds so roosting, for, in addition to the inclemency of the weather, horned owls are very numerous and very fond of partridge flesh. It is usual for this species to roost in spruce coverts or else in a snow drift, hence it may be concluded that these two birds simply made a mistake and paid dearly for it.

On May 3, 1884, in spruce bush, I collected three male partridges; one of the gray cast of plumage, with copper ruff; one brown, and one intermediate. All had their crops filled with poplar catkins.

On Thursday evening of May 29 I heard a partridge drumming in a low thicket by the slough. I continued to approach it by cautiously crawling while the bird was drumming and lying still while he refrained. When at length I was within 20 feet and yet undiscovered, I ensconced myself behind a thicket and settled myself to watch. The drummer was standing on the log with his head and crest erect, his tail spread but the feathers on his body compressed. After looking about unconcernedly for a moment, he seemed to crouch a little to brace himself, then the wings flashed with a *thrump*, followed by a stillness, and from the appearance of the bird one might think the performance ended, but after about six seconds there is another hazy flash of the wings, accompanied again by the *thrump*; in about two seconds it is repeated, and again in half a second, and again and again, faster and faster, until at last the strokes run into each other and roll away like "the rumbling of distant thunder." I watched the performance a number of times. Between each "tattoo" he did not strut but remained in the same place, merely turning his head about. Also satisfied myself that the wings beat nothing but the air. I had previously accepted this as the correct theory, because whether it stand on a sound or rotten log, a stump or a stone, the sound is always the same, and therefore it could not drum on the perch, nor could it make the sound by beating its wings together, for when a rooster or a pigeon strikes its wings together the sound is a sharp crack, so that there is no plausible explanation other than the one above given.

On June 19, on the west side of Duck Mountain, in a thick poplar woods, we came on a partridge that evidently had a nest or a brood close at hand. She ran about our feet with her ruffs and tail spread and her wings drooping, and whined in a manner that showed the reason of her anxiety, but we failed to find the young or eggs.

While exploring in the Carberry spruce bush, on July 3, with my friend, Mr. Miller Christy, we passed a tree at whose roots was a part-

ridge's nest, but would not have discovered it had not the mother pursued us some 20 feet that she might begin a vigorous attack on our legs, whereupon we turned and found the nest. It was just at that critical moment when the young were coming out. Those that were hatched, some six or eight, hid so effectually within a space of 6 feet that no sign of them could be seen after the first rush, and once hidden, they ceased their plaintive peeping and maintained a dead silence. Meanwhile the mother was sorely distressed, running about our feet with drooping wings, whining grievously in such entire forgetfulness of herself and in such an agony of anxiety for her young that the hardest hearted must have pitied her and have felt constrained to leave her in peace, as we did.

This nest contained one addled egg and one with a chick dead and dried in. The egg was $1\frac{1}{2}$ by $1\frac{1}{4}$, brown, with a few dots of umber.

Every fieldman must be acquainted with the simulation of lameness by which many birds decoy, or try to decoy, intruders from their nests. This is an invariable device of the partridge's, and I have no doubt that it is quite successful with the natural foes of the bird; indeed, it is often successful with man. More than once I have stood still when a clucking bird flew up, and laughed heartily to see some tyro rushing frantically after the limping mother, shouting "Come on! she's wounded!" A dog, as I have often seen, is certain to be misled and duped, and there is little doubt that a mink, raccoon, skunk, fox, coyote or wolf would fare no better. Imagine the effect of a bird's tactics on a prowling fox. He has scented her as she sits; he is almost upon her; but she has been watching him, and suddenly with a loud "*whirr*" (the whirr is essential, I think) she springs up and tumbles a few yards before him. The suddenness and noise with which the bird appears causes the fox to be totally carried away; he forgets all his former experiences; he never thinks of the eggs; his mind is filled with the thought of the wounded bird almost within his reach; a few more bounds and his meal will be secured. So he springs and springs, and very nearly but not quite catches her; in his excitement he is led on and away, till finally the bird flies off, leaving him a quarter of a mile or more from the nest.

If, instead of eggs, the partridge has chicks, she does not await the coming of the enemy, but runs to meet and mislead him ere yet he is in the neighborhood of the brood; she then leads him far away, and returning gathers her young together again by her voice.

When surprised she utters a well-known danger signal, whereupon the young ones hide under logs and among grass. Many persons say they will each seize a leaf in their beaks and then turn on their backs. I have never found any support for this idea, although I have often seen one of the little creatures crawl under a dead leaf.

By the end of September the young partridges are fully grown and very fat. At this time they commonly spend the night either squat-

ting under the evergreens or roosting in the trees; but when the weather gets cold and the snow lies deep and soft in the woods, they begin to sleep in the drifts, going down nearly a foot in the same manner as that described under the Prairie Chicken.

Their food at this time is chiefly browse, birch-catkins, and rose-hips, but in the summer and fall they live largely on insects, leaves, berries, and nuts. In September I shot some with their crops full of acorns.

The flesh of the partridge is ranked by many as the most delicate of all our game, while the bird affords the best of sport to those who hunt it fairly. But it is hard to understand the feeling of those who will beat a fine partridge bush with a cur that is trained to tree the bird and hold its attention by barking, while his comrade, guided by the uproar stealthily approaches within a few feet and after a long and deadly aim discharges half a pint of buckshot into the hapless bird, which, between the shot and the cur, is so mangled before the musketeer secures it that after all he gets but little more than he deserves.

It goes without saying that an object in motion catches the eye more quickly than one at rest, and it is evident also that so small an object in a landscape as a rabbit or partridge will almost certainly escape observation if it be completely at rest. This fact is so well known to most wild animals, especially those that are continually harassed by the predaceous kinds, that the moment they perceive the approach of an enemy they become motionless as statues, and, no matter what their attitude, move neither eye nor limb till they have thoroughly taken in the situation and satisfied themselves that there is nothing further to be gained by concealment. This habit I have often noticed in the partridge and have observed it maintain its fixity for a remarkable length of time under very trying circumstances.

A second purpose served by motionlessness is that of enabling the animal to observe accurately the motions of its enemy. An observer in motion can not accurately gauge the slight movements of another, and the only resource is to pause often so that the relative movements of the object watched may be gauged against the background. This end I conceive is exactly met by the nodding head of the walking partridge; its body continues in steady progression, but its eye or base of observation is for a moment in each step at a standstill, thereby giving it a great advantage.

On the 14th October, 1884, whilst Prairie Chicken shooting, we found and shot a large full plumaged male partridge on the open prairie, at least a mile from cover of any kind. This species exhibits great variation in plumage, hardly any two being alike. I have found the extreme phases as follows: Rufous plumage with black ruffs; gray plumage with black ruffs; both above colorations of plumage with copper ruffs and black tail bars.

Both colorations of plumage, with copper ruffs and copper tail bars; the great majority of birds, however, are intermediate between these phases. Between October 15 and December 9, 1886, near Winnipeg, I took one hundred and eighteen of these birds, amongst them thirty-one adults in full plumage. The following

memorandum, made at the time, shows the relative proportions of the above-mentioned phases:

A. Black ruff with rufus plumage.....	10
B. Copper ruff, rufus plumage, with copper tail band.....	2
C. Black ruff with gray plumage.....	8
D. Dark intermediate ruff, gray plumage.....	1

Intermediates:

Between A and C.....	4
Between B and D.....	2
Between A and D.....	3
Between A and B.....	1

The remainder of those taken exhibit every possible variation between these forms. (Nash, in MSS.)

98. *Lagopus lagopus*. Willow Ptarmigan, or White Partridge.

Abundant winter visitant to the wooded regions of the Northeast. Winnipeg: Winter visitor; rare; abundant at upper end of Lake Winnipeg (Hine). Swamp Island: 1885, first seen, a flock of about twenty on February 16; next seen on February 21; is common in severe winters only; is usually rare; does not breed here; 1886, first seen, about ten, on January 12; the bulk arrived March 8; last seen, March 21; was abundant this year (Plunkett). Northern part of Red River Valley: Transient visitor in winter and very rarely (Hunter). Near Lake Winnipeg, at Fort Cumberland and to the eastward, they are common every winter (Brewer). Very seldom to be seen south or west of Lake Winnipeg, but is found in all the country north and east of that lake during the winter season (D. Gunn). Portage la Prairie, 1884: Saw three brought from Lake Winnipegosis last winter (1883); it is said to be a regular winter visitant to Lake Manitoba, generally in January and February (Nash). In the year 1819 its earliest appearance at Cumberland House was in the second week of November (Richardson). Common every winter near Fort Cumberland (Blakiston). Norway House (Bell).

These birds are very numerous at the northern settlements, likewise on the eastern coasts of the bay. I have known upwards of ten thousand caught with nets at Severn from the month of November till the end of April. (Hutchins MSS, Observations on Hudson Bay, 1782.)

99. *Tympanuchus americanus*. Prairie Hen, or Pinnated Grouse.

Abundant resident in the cultivated sections. In 1872 Dr. Coues wrote: "I have no reason to believe that it occurs at all in northwestern Minnesota or northern Dakota. * * * I have met with no indication of its occurrence north of the United States boundary." In 1882, when first I visited Manitoba, the species was nearly unknown in the country, the only known specimens having been taken near Winnipeg in 1881. In 1883, Mr. Hine informs me, it began to be common at Pembina. In 1884 it was not only common at Winnipeg, but had also

made its appearance at Portage la Prairie, on the Assiniboine, where, according to Mr. Nash, it is now (1890):

Resident; increasing in number every year. The first I heard of was killed in the fall of 1882, about 8 miles north of Portage la Prairie. In 1883 I heard of them in one or two places. In 1884 I killed several and heard of them from most of my friends who shoot. Those I saw were all young birds except one. This was in full plumage. In April, 1885, I put up several single birds on a piece of breaking, and afterwards heard in various directions their peculiar booming. Since that they have become tolerably common.

Red River Valley, 1885: It is now a permanent resident here, but only during the past few years; they are gradually working their way north from Minnesota, and have appeared at Westbourne (Hunter). Carberry: In December, 1886, I found it had made an appearance there, having been observed; also at Melbourne; in 1890, Mr. Hine writes me that it was now an abundant summer resident (Thompson).

On December 1, 1886, was shown a Prairie Hen (*Tympanuchus americanus*) shot near by, and was told that young Ed. Thompson shot another here last fall. Previously the bird was unknown in the neighborhood. December 20, at Melbourne, 7 miles east of Carberry, saw two Prairie Hens. The species is evidently working towards the north and west, no doubt following the plow.

The first information I received of the appearance of the Pinnated Grouse in this province was from a farmer, living about 8 miles north of this town (Portage la Prairie), who had shot one in the fall of 1882. I did not see the bird, but from the description he gave me of it I could not mistake it. I immediately made inquiries among the hunters of this locality, but no one else had seen it. In the fall of 1883 I again heard of the bird in one or two places, but saw none myself. In the fall of 1884 it became plentiful, comparatively speaking, in this neighborhood, and to the eastward, that is to say between here and Winnipeg, I had the good fortune to secure two specimens in rather a lucky fashion. I was out with a friend chicken-shooting, October 6, 1884, at Burnside, a settlement 10 miles west of this town, when we saw a large flock of grouse alight in a stubble field near us. When we reached the field three birds got up, of which I killed two with the first barrel, and the other with the second barrel. Of the two first killed, one was a Pinnated Grouse, the other a Sharp-tailed Grouse; the one killed with the second barrel was a Pinnated Grouse. I got no others, but heard of them from nearly all of my acquaintances who hunt. Strange to say, all that were obtained, except one, appear to have been young birds, and this one was in full plumage, having on each side of the neck the long pointed feathers peculiar to the species. So far as I can learn with any degree of certainty, these birds are not yet (March, 1885) found much west of the place where I killed mine, nor farther north than 10 or 12 miles from Portage la Prairie. They are evidently working in here from Minnesota and Dakota, and are following the grain. Up to this time the Sharp-tailed Grouse has been very abundant, but, as might be expected, it is getting scarcer in the vicinity of the towns. So far, both birds here associate together when they pack and find food in the stubbles. (Nash, in Professor Cook's report on migration, 1885).

In 1886, near Winnipeg, I found them abundant, about one-third of the Prairie Grouse seen being of this species. They do not visit the deep woods as do the Sharp-tailed Grouse, but in the winter frequent the willow shrub for shelter. Nor do they so often alight on trees as the other species. The serrations attached to their toes are much smaller than those of either the Ruffed or Sharp-tailed Grouse, which may perhaps be the reason.

When feeding on the stubbles both species of Prairie Grouse associate together in the packs, but separate when the Sharp-tails go into the woods. (Nash, in MSS).

100. *Pediocætes phasianellus*. Northern Sharp-tail Grouse.

Resident in the Northeast. Some of these birds were shot near Dogs-head Lake, Winnipeg; thence I have found them eastward, as far as Long Lake and Pie River, on Lake Superior (Bell, 1880). Mr. Ridgway informs me that the Smithsonian Institution has a specimen of true *phasianellus* from Lake Winnipeg; at Rat Portage also I saw several specimens shot in the vicinity (Thompson). Trout Lake Station (Murray). In great plenty near Cumberland House (Hearne, 1771).

I have seen them in great plenty near Cumberland House * * * frequently perch on the tops of the highest poplars, out of moderate gunshot, and will not suffer a near approach. They sometimes, when disturbed in this situation, dive into the snow; but the sportsman is equally balked in his expectations, as they force their way so fast under it as to raise for flight many yards distant from the place they entered, and very frequently in a different direction to that from which the sportsman expects. This I assert from my own experience when at Cumberland House. (Hearne.)

Aukuskou. Pheasant grouse * * * . These birds keep in pairs or small flocks and frequent the Juniper plains all the year. The buds of these trees are their principal food in winter, as their berries are in summer. They generally inhabit about the same spot, unless disturbed; their flights are short. They frequently walk on the ground, and when raised will fly on the top of an adjacent tree. In June they make a nest on the ground with grass and line it with their own feathers. They lay from four to seven white eggs, with colored spots, and bring forth their young about the middle of June. (Hutchins MSS., Observations on Hudson Bay, 1782.)

Rat Portage, October 11, 1886. Some Indians came to the door to-day with Prairie Chickens to sell. So far as I could judge these did not differ from specimens seen at Port Arthur, and were probably referable to the typical form. (E. E. T.)

100a. *Pediocætes phasianellus campestris*. Prairie Chicken.

Abundant and resident throughout the South and West (the Carberry form is, according to Mr. Ridgway, nearer to *campestris* than to *phasianellus*); abundant resident; abounds from Pembina to the Rockies, along the line (Coues). Winnipeg: Stinking River and Long Lake; summer resident; abundant (Hine). Red River Settlement (Blakiston). Several times observed from the trains between Winnipeg and Rat Portage (Thompson). Ossowo: Resident; breeding (Wagner). Portage la Prairie: Abundant; resident (Nash). Very abundant on the prairies from Livingstone southward in 1881, but not noted at all in the Winnipegosis region (Macoun). Carberry: Abundant; resident; partly migratory, as it lives on the prairies in summer and in the woods in winter; noted at Sewell, Chater, Brandon, north slope of Turtle Mountain as far as Pelican Lake, throughout the country from Carberry to Fort Ellice, and northwards in prairie localities to Cote's Reserve (Thompson). Qu'Appelle: Common; permanent resident; breeds (Guernsey).

April 18, 1882. Saw a flock of about thirty Prairie Chickens. Shot

one and identified it as the *Pediocætes phasianellus*. It was a female. Length 17, extension $25\frac{1}{2}$ inches. The pectinations on the toes very imperfect. Some of its comrades flew off and perched on tops of the highest trees. While the one I had shot was struggling in the agonies of death, its tail was rapidly vibrated, so that the hard stiff feathers of which it is composed produced a loud rustling noise, somewhat like the sound of a newspaper shaken violently.

April 19. Large numbers of Prairie Chickens about. They are said to be returning from the woods.

April 21. Numbers of Prairie Chickens about. One was on the roof of the shanty making a curious crowing noise.

April 28. Went to spruce brush with A. S. T. On the road he showed me a Prairie Chicken. I dropped it at 40 yards with a half charge of No. 12. My brother remarked that they were never alone at this season; there must be another near by; and presently I saw its head in the grass and added it to our bag. Both were males.

No. 1. Length 18, extension 26 inches; bare skin over the eye, bright chrome-yellow; air sacs purplish; all pectinations gone from the toes but about 6 points; claws very blunt.

No. 2. Length 18, extension 27 inches; exactly as above, but pectinations of the toes complete yet and claws quite sharp.

May 8. Prairie Chickens abundant now on the prairies.

May 9. Three Prairie Chickens brought to me to-day by the boys; two males; one female; crops of all were filled with willow catkins, sand-flowers (*Anemone patens*), and rose-hips. The female was without the air-sacs on the neck or the yellow over the eye. One had no pectinations on the toes, the other two had the imperfect remains of them only.

May 10. Prairie Chicken (male) shot to-day shows no pectinations whatever on the toes.

May 12. Brandon. C. T. shot a Prairie Chicken (female). In the oviduct was an egg nearly ready to be dropped; it was of a very pale blue; about the color of a blue-bird egg.

May 15. Camp 30 miles south of Souris. Shot a Prairie Chicken; (female); toes quite clear of pectinations; gizzard and crop filled with rose-hips and the fleshy flower receptacles of the sand-flower (*Anemone patens*).

May 16. Camp 10 miles east of land office, Turtle Mountain. Shot a Prairie Chicken (female); no pectinations on toes; crop full of willow catkins and sand-flowers; one egg ready to be laid; it is pale bluish olive in color.

Sept. 23. Prairie Chickens were numerous to-day in a little grove just west of the house. Specimens shot showed the feathering of the legs and the pectinations of the toes in full development.

In Manitoba this bird is always spoken of as the Prairie Chicken. I have several times heard this name objected to by Eastern naturalists

as being preoccupied by the *Tympanuchus americanus*, but I would submit that the latter is always known as the *Prairie Hen*;^{*} and though but a fine distinction it is a distinction, and it is better that it should remain, rather than attempt the alteration of nomenclature that has become as much a part of the language as the conjugation of the verb "to be."

This eminently prairie bird in the summer time usually retires to the woods and sand hills on the approach of winter; but in the spring, before the snow is gone, they again perform a partial migration and scatter over the prairies, where alone they are to be found during the summer. They are very shy at all times, but during the winter the comparatively heedless individuals have been so thoroughly weeded out by their numerous enemies that it requires no slight amount of stalking to get within range of a flock in the springtime.

The advent of the grouse on the still snow-covered plains might prove premature, but that they find a good friend in the wild prairie rose (*Rosa blanda*). It is abundant everywhere, and the ruddy hips, unlike most fruits, do not fall when ripe, but continue to hang on the stiff stems until they are dislodged by the coming of the next season's crop. On the Big Plain stones of any kind are unknown, and in nearly all parts of Manitoba gravel is unattainable during the winter; so that the "chicken" and other birds that require these aids to digestion would be at a loss were it not that the friendly rose also supplies this need; for the hips, besides being sweet and nutritious, contain a number of small, angular, hard seeds, which answer perfectly the purpose of the gravel. To illustrate the importance of this shrub, in this regard, I append a table of observations on the crops and gizzards contents of grouse killed during the various months as indicated:

January.—Rose-hips, browse, and equisetum tops.

February.—Rose-hips and browse.

March.—Rose-hips and browse.

April.—Rose-hips and browse of birch and willow.

May.—Rose-hips and sand-flowers (*Anemone patens*).

June.—Rose-hips, grass, grasshoppers, and *Proconia costalis*.†

July.—Rose-hips, seeds of star-grass, and *P. costalis*.

August.—Rose-hips, grass, strawberries, and *P. costalis*.

September.—Rose-hips, grass, berries, and *P. costalis*.

October.—Rose-hips, grass, and various berries.

November.—Rose-hips, birch and willow browse, and berries of *arbutus*.

December.—Rose-hips, juniper berries, and browse.

This is, of course, a mere list of staples, as in reality nothing of the nature of grain, fruit, leaves, or insects comes amiss to this nearly omnivorous bird, but it illustrates the importance of the rose-hips, which

^{*} Unfortunately, this is an error. One rarely hears the name *Prairie Hen* applied to the *Tympanuchus* in the prairie States, where its almost universal name is *Prairie Chicken*, often shortened to simply *Chicken*.—R. R.

†As this insect is found all summer, it may prove not *costalis*, but a nondescript.

are always attainable, as they grow everywhere and do not fall when ripe. In the course of my experience I have examined some hundreds of gizzards of the Prairie Chicken, and do not recollect ever finding one devoid of the stony seeds of the wild rose. It is probable that the service is mutual, for these seeds secure a better distribution after being swallowed by the grouse; and as they were passed out with possibly increased vitality they may germinate more readily for the thinning their outer coat would receive during the grinding operation.

After the disappearance of the snow and the coming of warmer weather, the chickens meet every morning at gray dawn in companies of from six to twenty on some selected hillock or knoll and indulge in what is called "the dance." This performance I have often watched. It presents the most amusing spectacle I have yet witnessed in bird life. At first, the birds may be seen standing about in ordinary attitudes, when suddenly one of them lowers its head, spreads out its wings nearly horizontally and its tail perpendicularly, distends its air sacs and erects its feathers, then rushes across the "floor," taking the shortest of steps, but stamping its feet so hard and rapidly that the sound is like that of a kettle drum; at the same time it utters a sort of bubbling crow, which seems to come from the air sacs, beats the air with its wings, and vibrates its tail so that it produces a low, rustling noise, and thus contrives at once to make as extraordinary a spectacle of itself and as much noise as possible.

As soon as one commences all join in, rattling, stamping, drumming, crowing, and dancing together furiously; louder and louder the noise, faster and faster the dance becomes, until at last, as they madly whirl about, the birds are leaping over each other in their excitement. After a brief spell the energy of the dancers begins to abate, and shortly afterwards they cease and stand or move about very quietly, until they are again started by one of their number "leading off."

The whole performance reminds one so strongly of a Cree dance as to suggest the possibility of its being the prototype of the Indian exercise. The space occupied by the dancers is from 50 to 100 feet across, and as it is returned to year after year, the grass is usually worn off and the ground trampled down hard and smooth. The dancing is indulged in at any time of the morning or evening in May, but it is usually at its height before sunrise. Its erotic character can hardly be questioned, but I can not fix its place or value in the nuptial ceremonies. The fact that I have several times noticed the birds join for a brief set-to in the late fall merely emphasizes its parallelism to the drumming and strutting of the partridge, as well as the singing of small birds.

The whole affair bears a close resemblance to the maneuvering of the European Ruff, and from this and other reasons I am inclined to suspect the Sharptail of polygamy. When the birds are disturbed on the hill they immediately take wing and scatter, uttering, as they rise,

their ordinary alarm note, a peculiar vibratory "*cack, cack, cack.*" This is nearly always uttered simultaneously with the beating of the wings, and so rarely, except under these circumstances, that at first I supposed it was caused by the wings alone, but since have heard the sound both when the birds were sailing and when they were on the ground, besides seeing them fly off silently. They have also a call—a soft, clear whistle of three slurred notes; E A D—and a sort of grunt of alarm, which is joined in by the pack as they fly off. Their mode of flight is to flap and sail by turns every 40 or 50 yards, and so rapid and strong are they on the wing that I have seen a chicken save itself by its swiftness from the first swoop of a Peregrine Falcon, while another was seen to escape by flight from a Snowy Owl.

The nest of this species is placed in the long, rank grass under some tuft that will aid in its concealment, and is usually not far from a tract of brush land or other cover. It is little more than a slight hollow in the ground, arched over by the grass. The eggs, usually fourteen, but sometimes fifteen or sixteen in number, are no larger than those of the common pigeon, and are actually smaller than those of the Upland Plover, a bird which is only one-eighth of the chicken's weight. Immediately before expulsion they are of a delicate bluish green; on being laid they show a purplish grape-like bloom; after a few days exposure they become of a deep chocolate brown, with a few dark spots. After a fortnight has transpired they are usually of a dirty white; this change is partly due to bleaching and partly to the scratching they receive from the mother's bill and feet.

A partial history of the young in a wild state is briefly as follows: At the age of 6 weeks they are fully feathered and at 2 months fully grown, although still under guidance of the mother at this time. There is usually not more than six or seven young ones left out of the original average brood of fifteen, which statement shows the number of chicks which fall a prey to their natural enemies, while many sets of eggs also are destroyed by the fires which annually devastate the prairies. As the fall advances they gather more and more into flocks and become regular visitors to the stubble fields, and, in consequence, regular articles of diet with the farmers until the first fall of snow buries their foraging grounds and drives them en masse to the woods.

During the summer the habits of the chickens are eminently terrestrial; they live, feed, and sleep almost exclusively on the ground; but the first snow makes a radical change. They now act more like a properly adapted perching bird, for they spend a large part of their time in the highest trees, flying from one to another and perching, browsing, or walking about among the branches with perfect ease, and evidently at this time preferring an arboreal to a terrestrial life. When thus aloft they are not at all possessed of that feeling of security which makes the similarly situated Ruffed Grouse so easy a prey to the pot-hunter. On the contrary, their perfect grasp of the situation usually

renders them shy and induces them to fly long ere yet the sportsman has come near enough to be dangerous.

Like most of the members of its family, the Prairie Chicken spends the winter nights in the snow, which is always soft and penetrable in the woods, although out on the plains it is beaten by the wind into drifts of ice-like hardness. As the evening closes in the birds fly down from the trees and either dive headlong into a drift or run about a little and select a place before going under. The bed is generally about 6 inches from the surface and a foot long from the entrance. Each individual prepares his own place, so that a flock of a dozen chickens may be scattered over a space of 50 yards square. By the morning each bird's breath has formed a solid wall of ice in front of it, so that it invariably goes out at one side. The great disadvantage of the snow bed is, that when there the birds are more likely to become the prey of foxes and other predaceous animals, whose sagacious nostrils betray the very spots beneath which the unsuspecting bird is soundly slumbering. I am inclined to think this is the only chance a fox has of securing one of the old birds, so wary are they at all other times.

As the winter wanes it is not uncommon for a snowstorm to be accompanied by sleet. The storm at once drives the chickens into the drifts and afterwards levels the holes they formed in entering. The freezing of the sleet then forms a crust which resists all attempts at escape on the part of the birds, many of which, according to the account of hunters, are starved and thus perish miserably. I met with a single instance of this myself.

Before the winter is over, many of the birds, by continuously pulling off frozen browse, have so worn their bills that when closed there is a large opening right through immediately behind the hook.* Early in April the few that have survived the rigors and perils of their winter life spread over the prairie once more and soon scatter to enter on their duties of reproduction.

The growth and shedding of the pectinations on the toes I have recorded at length, and not having heard of any use for them, conceived the idea which I have already published (1883), that they are intended to act as snowshoes, and the fact that they grow in the fall and continue in perfection all winter, only dropping off after the snow is gone, justifies this conclusion. The same remark applies to the similar appendages of the Ruffed Grouse. The tail seems to present a curious specialization, most marked in the outer feathers; its chief function in life appears to be making a noise. The central pair of soft, long, silent feathers stand out like monuments of what the tail used to be in the palmy days of the species, when not mere hubbub in the madding crowd on the noisy dance-hill, but dainty decoration was the charm by which chiefly the *pediocætes* wooed and won his mate.

* The same remark applies to the partridge.

101. *Ectopistes migratorius*. Wild Pigeon.

Tolerably common summer resident of wooded regions; countless flocks in Red River Valley late May and early June, 1873; breeding; a few seen in Turtle Mountain (Coues). Dufferin: Arrived May, 7, 1874 (Dawson). Winnipeg: Summer resident; tolerably common (Hine). Ossowo: Rare; breeding; 1885, first seen, two, on April 18; next seen, April 19; seldom seen here (Wagner). Oak Point: 1884, arrived June 20 (Small). Portage la Prairie: Common summer resident; arriving about the first week in May, departing at the end of September; on May 21 fresh eggs were found (Nash). Sarden Island, Lake of the Woods; Pennawa River; Fort Garry, 1858, pigeon nets were in use near Fort Garry; Portage la Prairie, 1858, June 17, pigeons were flying in vast numbers over the Assiniboine; Souris River, near Spencer Knob, 27 June, 1858, vast numbers of pigeons were flying in a northwesterly direction (Hine). Found a few breeding on Waterhen River in 1881; about a dozen nests; in early fall saw great numbers in the Swan River region (Macoun). Carberry: Tolerably common spring migrant; probably breeding; south slope of Riding Mountain (Thompson). Two Rivers: 1885, on May 14, saw several; they did not alight (Criddle). Shell River: 1885, first seen, five, on June 15; odd pairs breed here (Caltutt). Qu'Appelle: Occasional; May 10 (Guernsey).

On May 17, 1884, saw flocks of wild pigeons flying westward, and on July 22, Portage la Prairie, saw a number in the woods along the river. Apparently they breed in this region, and if so, no doubt as isolated pairs, for I am not aware of the existence of any extensive rookeries in the province.

Pigeons of a small size, not larger than a thrush, are, in some summers, found as far north as Churchill River. The bill is of a flesh color, legs red, and the greatest part of the plumage of a light lilac or bluish. In the interior parts of the country they fly in large flocks and perch on the poplar trees in such numbers that I have seen twelve of them killed at one shot. They usually feed on poplar buds and are good eating, though seldom fat. They build their nests in trees, the same as the Wood Pigeons do; never lay but two eggs, and are very scarce near the seacoast in all the northern parts of Hudson's Bay. (Hearne.)

Merne rouch pigeons. The first species I shall take notice of is one I received at Severn, in the year 1771, and, having sent it home preserved to Mr. Pennant, he informed me it was the migratoria species. They are very numerous inland and visit our settlement to the southward in summer. They are plenty about Moose Fort and inland, where they breed, choosing an arboreal situation. The gentlemen number them amongst the many delicacies Hudson's Bay affords our tables. 'T is a hardy bird, continuing with them till December. In summer their food is berries, and when these are covered with snow they eat the juniper buds. They lay two eggs and are gregarious. * * * About twenty-six years ago these pigeons migrated up as high as York Fort, but continued only two days. (Hutchins MSS.; Observations on Hudson's Bay, 1782.)

A few hordes of Indians that frequent the low flooded tracts at the south end of Lake Winnipeg subsist principally on the pigeons during a period of the summer when the sturgeon fishing is unproductive and the *Zezenia aquatica* has not yet ripened, but

farther north these birds are too few in number to furnish a material of diet. (Richardson, 1827.)

Garden Island, Lake of the Woods. Large flock of Passenger Pigeons (*Columba migratoria*) flew backwards and forwards over the island, occasionally alighting in dense masses in the small groves. (Hind, August 24, 1857.)

In a wheat field opposite St. James Church (2 miles west of Fort Garry) were several pigeon traps, constructed of nets 20 feet long by 15 broad, stretched upon a frame. One side was propped up by a pole 8 feet long, so that when the birds passed under the net, to pick up the grain strewed beneath, a man or a boy, concealed by a fence or bush, withdrew the prop by means of a string attached to it, and sometimes succeeded in entrapping a score or more of pigeons at one fall. Near the net some dead trees are placed for the pigeons to perch on, and sometimes stuffed birds are used as decoys to attract passing flocks. (Hind, 1858.)

On Waterhen River, June 23, 1881, I found a few wild pigeons breeding. There was under a score of nests and they were variously placed, some of them but 10 feet from the ground and not in large trees. They were such flimsy structures that the eggs were clearly seen through the interstices from below, and one old bird was shot as she sat.

In the latter part of August and the early part of September I saw great flocks on the Upper Assiniboine, and on Swan River above Livingston. They were feeding on the berries of *Cornus stolonifera*. In all my travels in the northwest I have never since found them breeding. (Prof. John Macoun in MSS.)

I think, too, we have far less birds than formerly, especially wild fowls and pigeons. I remember when I used to see flocks of pigeons following the course of the Red River which were so large that the front of each flock was out of sight in the north whilst the tail was out of sight in the south, but they never come now.. (Donald Murray's statement in 1887 to Miller Christy, referring to the early days of the colony.)

They breed early, as I shot a female on May 31, 1884, containing an egg properly shelled and just ready for extrusion.

They do not in this locality build in colonies, but place their nests singly, usually in small oaks, the males at the time the females are incubating keeping in small flocks.

On the 27th of June, 1885, I shot fourteen of these birds, all males, each one of them having its crop crammed full of green caterpillars, mostly of one species of *geometra*.

Early in July the young appear with the old ones of both sexes. (Nash, in MSS.)

102. *Zenaidura macroura*. Mourning Dove.

Rare summer resident of the southern part of the first prairie steppe; common at Pembina in June (Coues). Winnipeg: Rather rare (Hine). Portage la Prairie: Tolerably common summer resident near here, breeding in small wild plum trees; arrives in May; nest found containing two eggs, on which bird was sitting June 7, 1885; not observed by me near Winnipeg (Nash). Never seen at Carberry; once noted at Turtle Mountain, May, 1882 (Thompson). Qu'Appelle: Common summer resident; breeds; arrives May 12 (Guernsey).

103. *Cathartes aura*. Turkey Vulture.

Tolerably common in summer and probably breeding; frequently seen in the Red River region at the boundary (Coues). Winnipeg: One or two observed (Hine). Red River Settlement: On the 27th of April, 1859, the winter snow was covering the ground to the depth of a foot, while the rivers were still bound; the only part of the interior of

British North America, as far as I can ascertain, that it inhabits in the prairie country that lies to the south and west of Lake Winnipeg (Blakiston). Portage la Prairie: 1884; scarce summer resident; first seen May 23; occasionally seen in April and May, and again in September, generally near the Assiniboine River; not observed near the Red River (Nash). Tolerably common summer resident at Carberry; not known to breed; near Turtle Mountain; Fort Ellice; Coté's Reserve (Thompson). Two Rivers: Rare; two seen hovering over bank of river, May 2 (Criddle). Shot near Westbourne in 1881 (Macoun). Upper Assiniboine (Bell). Plains of the Souris near Pipestone Creek (Hurd, July, 1858). Qu'Appelle: Common summer resident; breeds; arrives May 20 (Guernsey). Shell River: 1885, first seen, two, on April 25; here all summer at times, but not breeding (Calcutt).

In Minnesota, abundant; breeding. The Turkey Buzzard usually selects the hollow prostrate trunk of a large tree for its nest. I found young birds nearly fledged as late as the 29th of July. There are usually two young, occasionally but one. This bird is capable of withstanding considerable cold. I saw it on the 24th of October, and again on the 8th of December. (T. M. Trippe.)

104. *Elanoides forficatus*. Swallow-tailed Kite.

A rare straggler; observed in northern Minnesota near the boundary (Thompson). Occasional at Pembina (Coues). Winnipeg: Accidental visitant; rare (Hine). Noticed at Selkirk, Pembina Mountains, and Fort Qu'Appelle (Hunter).

105. *Circus hudsonius*. Harrier, or Marsh Hawk.

Abundant summer resident, chiefly in the prairie regions; common along the boundary from Pembina to Rockies; next found at Pembina (Coues). Dufferin: Arrived before April 15 (Dawson). Winnipeg: Summer resident; abundant (Hine). Spring of 1859; did not observe it before the 28th of that month (April) at Red River Settlement (Blakiston). Ossowa: Common; breeding, 1885; last seen, one on November 12 (Wagner). Oak Point: 1884, arrived April 27; 1885, first seen, one on April 8; is common and breeds here (Small). Portage la Prairie: 1884; very common summer resident; first seen April 11; birds in the full blue plumage being occasionally seen; arrive early in April; are abundant by the middle of the month; depart at the end of October (Nash). Carberry: Our commonest hawk; summer resident near Turtle Mountain; near Shoal Lake, west; the adults in blue plumage common in spring and fall, rare at other times (Thompson). Brandon: April 10, 1882 (Wood). Common in the Winnipegosis region, but exceedingly abundant on the marshy prairies from Livingston southward along the Assiniboine, September, 1881 (Macoun). Qu'Appelle: Common summer resident; breeds; arrives April 15 (Guernsey). Adult male, Cumberland House (Richardson). Severn House (Murray).

September 28, 1882: The full plumaged Gray Harriers are here once more. This bird comes earlier in the spring than the brown plumaged

harrier, goes farther north to breed, migrates later in the fall, and flies differently, so that if it is the same bird, the case is a unique one.

On October 3, 1883, watched a Blue Harrier capture a junco in full flight; the latter exhibited some extraordinary feats on the wing, but the harrier was always close behind, and followed up, down, into the grass or along, and in a few seconds he flew off with the sparrow in his talons. I am very sure the powers of flight of this hawk are much beyond those of a Brown Harrier.

On October 3, near Shoal Lake, west, saw a Blue Harrier trying to catch some teal that were on a very small shallow pond. Each time the harrier pounced the teal would dive below the surface, and at the same time splash the water up as high as possible. This happened several times, and at length the baffled harrier gave up the attempt.

On May 13, 1884, saw a hawk flying over the slough with a deeply undulated flight. At each ascending part it uttered a cackling which sounded like something between the shrill piping of a snipe and the chuck-chuck of a rooster calling the hens; then it dashed on the downward line, repeating the maneuvers for half a mile, when it was lost to sight. This bird seemed black above, and pure white beneath; tail, long.

On May 19 a harrier was sitting on a tussock in the middle of the slough. It was easily approached by an old and never-failing plan. I fixed my eyes on a point in the horizon, which was so situated that by going toward it I must pass within 30 yards of the hawk. I then walked straight to my mark, never turning my head or even my eyes, else the bird had surely flown. When at the nearest point I turned suddenly; immediately the hawk sprang, but at once fell to my gun.

It proved a female and had a *white breast* and slaty-brown back. In the gizzard was a gopher which had evidently been stealing wheat, when the harrier caught and lynched him on the spot. Certainly this is a plea for the hawk. Six of the grains were in good condition, though much swollen. They were planted but failed to germinate, doubtless because saturated with the harrier's gastric juice, but most likely the greater part of the gopher's cargo was spilt where he was devoured, so that this illustrates one natural mode of distributing seed.

I have made many other observations on the food of this bird in Manitoba, and all point to gophers as the staple, blackbirds and sparrows as occasional varieties. I once saw an old one trying to capture some young ducks, but the mother duck contrived to keep him at bay by splashing until the ducklings escaped into cover.

May 20, saw a hawk flying in a most extraordinary fashion. Its course was excessively undulated, with the ascending parts nearly perpendicular, the descending in a long oblique, the outline being that of a huge rip-saw. During the first upward bound it uttered a continuous cackling, much like the note of a snipe, then plunged silently downward, again to bound upward; when at the highest point this time it turned a

complete somersault, then plunged again, and repeated this series of actions a number of times, then set its wings rigidly and sailed away in a straight line, never flapping once till out of sight. It was a gray hawk with a white breast and seemed a perfect master of aërial navigation.

July 13, at the slough saw a hawk sailing about and squeaking like a snipe. It continued sailing very near and seemed in no fear of me, but of course I had no gun. A kingbird launched out from a bush and gave chase; the hawk rose higher and higher till the kingbird was lost to sight; soon the latter returned and afterward the hawk. This happened twice and made me think it was a Red-tailed Buzzard.

As he did not seem disposed to go away, I went home and in half an hour returned with a gun. He was still there and soon again came sailing and squeaking over me. He made a swoop which brought him very near; then *crack!* and he fell headlong. I ran to pick up my prize to find the Arctic hawk, at last, and lo! my old friend the harrier, the commonest of our predacious birds.

August 9, I shot an adult female harrier at the same place as last taken. She also was uttering the peculiar cackling, though not flying after the manner described. Her gizzard contained a mass of pulp which was full of what looked like raspberry seeds. I think it likely she had swallowed a gopher whose stomach was full of that fruit.

On September 9, on the edge of the grain field, in the evening, saw a harrier (brown) pounce on a Prairie Chicken, but the latter struggled, and at length got free and made a dash for life, with the harrier in close pursuit, but to my surprise the chicken gained at every beat, and in less than 100 yards the harrier gave up the chase and turned about in search of gophers, grasshoppers, and other game more within his reach.

The Marsh Harrier (*Circus cyaneus hudsonius*) is a very common bird throughout Manitoba, and may often be seen sailing over the prairies, the sloughs, or the wheat fields. One morning late in August I remember counting a dozen round one house. * * * Nearly all the individuals I saw were in the brown plumage; only three or four wore the adult bluish ash-colored dress. This bird comes often and inspects the settlers' chickens, but seldom carries off any except very young ones—gophers, mice, and grasshoppers being its usual prey. It is exceedingly easy to shoot and one or two dead ones may often be seen lying round a farmer's house. The harrier became a much scarcer bird as September wore on (Christy.)

These hawks are very fond of eating the ducks that are killed and lost by sportsmen, and where much shooting is done in a marsh you may see numbers of carcasses of ducks half devoured by this bird. On one occasion a harrier tried to take from me a wounded teal that had crossed a creek on the bank of which I was shooting. Before I sent my dog for the duck the hawk came, hovering over the creek, and seeing the prostrate bird immediately pounced on its back, but the teal fluttered and threw him off for the moment. As I wished to see the result I kept perfectly quiet, and the hawk, not noticing me, settled down on the ground about 2 feet from the duck and watched for some time; at last, apparently tired of waiting for the wounded bird to die, he went off. These birds should never be destroyed; as, though occasionally they may take a young or wounded duck, their prey is usually mice and gophers. (Nash, MSS.)

106. *Accipiter velox*. Sharp-shinned Hawk.

Summer residents of woodlands. Dufferin: Arrived before April 15 (Dawson). Mouse River at the boundary (Coues). Winnipeg: Summer resident; tolerably common; April 15 to October 15 (Hine). Specimens in Smithsonian Institution from Red River Settlement, and from between Hudson's Bay and Lake Winnipeg (Blakiston). Portage la Prairie: Common in spring and autumn, but not often seen during the summer; arrives in April and departs in October; in 1884 arrived, first appearance, April 16 (Nash). Carberry: One taken October 5 (Thompson). Observed in Winnipegosis county; saw a number near Côté's Reserve, and shot one at Livingston, September 11, 1881 (Macoun).

This audacious little robber is about the commonest hawk in the wooded section about Portage la Prairie, but owing to his hiding propensities he is not so much noticed as the others. His usual habit of hunting is thus: He skims along low amongst bushes and shrubs, constantly alighting on the branches, and woe to the unfortunate sparrow or other small bird that fails to drop into the grass before he arrives, for if the little bird is once seen it rarely escapes; for, unlike most hawks, this fellow will follow his prey through the thickest places, hopping and running after him with the greatest rapidity. I have, when quietly seated in the brush, been frequently warned of the approach of this hawk by the sudden cessation of song around me, and the utterance of a peculiar plaintive squeak by the small birds in the vicinity, upon which they all drop down and hide, and in a moment my ghost-like friend glides like a shadow on the scene, drops on a low branch for a second, and then passes on. Sometimes, however, I have seen this hawk strike at and pursue a bird in the air, like a true falcon, and on one occasion an impudent villain of this species glanced past my head and snatched up a plover I had shot, carrying it off in front of my dog's nose, and this he did before the report of my gun had died away, and through the smoke from the charge. The act so astonished me that I forgot to shoot at him until he was too far off; when I did remember, I sent the other charge after him, but without effect; he did not even drop his ill-gotten spoil. On another occasion one followed a redpoll almost into my buggy. On the 22d of August I saw one strike at a Bronzed Grackle and carry it off from where it was feeding in a public street, at Portage la Prairie, although there were many people about.

I have occasionally seen this bird hover like the kestrel, but very rarely. (Nash, in MSS.)

107. *Accipiter cooperi*. Cooper's Hawk. Chicken Hawk.

Winnipeg: Summer resident; tolerably common (Hine). I have seen them at Oak Lake, west of Brandon, where they breed; and saw a pair on 10th May, 8 miles south of Troy depot, Canadian Pacific Railway, west (R. H. Hunter). North to the Saskatchewan (Brewer).

108. *Accipiter atricapillus*. American Goshawk.

Tolerably common fall and winter visitant; usually appearing in August. Winnipeg: Winter visitant abundant; November 15 to March 1 (Hine). Portage la Prairie (Nash). Carberry: Tolerably common in fall and early winter; usually appearing in August; not noted during breeding season. Rat Portage: Fall (Thompson). A regular but uncommon winter visitor; more frequently seen near the Red River near Winnipeg (Nash).

On August 27, 1883, George Measham brought a large goshawk that he had shot by the north slough; young female; length 24, extension 44; weight, $2\frac{1}{2}$ pounds good. It is a very big, heavy bird; legs, all reticulate except in front, where they are scutellate; plumage very pale, streaked all over; a white line over the eye; its throat and stomach were filled with bad meat, but there was nothing to show of what kind.

On September 14 I secured a living goshawk by a curious combination of circumstances. Some days before a harrier had been shot over at Wright's while chasing the chickens and was left where it fell; and on the day in question the chickens were picking at the now odorous body of their late foe, when three great gray hawks came wheeling overhead, and presently one of them pounced down among the fowls. Away they ran for shelter, all save one, which was carried off and the three pirates circled away and down onto the prairie to enjoy their repast, where, lo! to their infinite disgust, they found that the only chicken which had not fled was the dry and musty dead harrier. In the meantime I had started after them with the gun, and by the never-failing trick of pretending not to see them, for there was not a stick of cover, I got within shot and secured a bird with each barrel. One of them was only winged and after a short chase he was captured and taken home.

Here I kept him for over a month, but finding that his wing was not likely to heal I killed him. During the time he lived he lost no whit of his inborn ferocity; he was kept chained by the entrance to the garden, and so far as hens were concerned he answered perfectly as a gate. He was always ready for a fight when any dog came near; but I found that by approaching cautiously I could seize his feet, after which he was powerless to inflict any injury.

The flight of this fine species is worthy of the true falcon, for it is so dashing and swift that the common buzzards look very slow and clumsy in comparison.

January 13, 1887, at Rat Portage, was shown the remains of a goshawk shot here last fall.

I have seen these birds strike at Sharp-tailed Grouse and at tame pigeons, but they do not seem to be successful in their efforts very often, for I never saw them catch one nor do they appear to follow up their game after making their dash at it. (Nash, in MSS.)

109. *Buteo borealis*. Red-tailed Hawk.

(Possibly *krideri*, as a breeding specimen from Chippewa Lake, Minnesota, is so identified by Mr. Ridgway.) Tolerably common summer resident of the wooded regions; one taken on Mouse River, at the boundary, in September (Coues). Winnipeg: Summer resident; rare (Hine). I saw numbers at Red River Settlement in the spring of 1859 (Blakiston). Portage la Prairie: Tolerably common summer resident,

frequenting the skirts of the woods (Nash). Carberry: Common summer resident in wooded localities near here; Duck Mountain, observed breeding (Thompson). Brandon Hills: Nesting, June 4, 1882 (Wood). Shot one fine specimen at Livingston, September 13, 1881 (Macoun). Shell River: 1885, first seen, one, male, on April 5, afterward seen every day; is a common summer resident, and breeds here (Calcutt).

By June 10, 1884, the Red-tailed Hawk was an abundant species in the Duck Mountain wooded region, much more so than the Swainson Hawk, which is the prevailing species on the prairie region of southern Manitoba. June 18, at Duck Mountain, shot a Red-tailed Hawk, female; length 20, extension 48. It seems to me to be the eastern bird, and not at all approaching *krideri*. On July 9, as I drove with Dr. Gilbert past a part of the plain on which were a few scrub oaks, I saw a Red-tail perched on a post. As we drew near he flew, but dropped a small animal; but before he could secure it he was attacked by another Red-tail, and for some time their brilliant tourney in the air was an interesting sight. Again and again the uppermost bird would charge swiftly on the other, which would thereat alight on the earth and so avoid the onslaught, or if too high for that means of escape would, with a graceful sweep, turn on his back and strike upwards with his heavy feet. The combat was ended at last by the weaker taking refuge in an oak. In the meantime I had stepped in and secured the booty which caused the strife. It was a very fine specimen of the Scrub Gopher (*Spermophilus franklini*), a rare animal; so it was thankfully received as an addition to my collection.

This species seems to be the complement of Swainson's Hawk in Manitoba, adhering to the forest regions, while the latter is found only in the more open places. The differences of habit presented by these two species are slight but quite appreciable, and are of a class that, taken as a whole, incline me to lay down a law that no two species of animal have the same exact environment, aside from the hypothetical fact that no animal fulfilling exactly the same conditions would necessarily be of the same species. I find that each species, as it is further studied, shows that it is adapted to a set of conditions slightly different from those of its nearest congeners.

110. *Buteo lineatus*. Red-shouldered Hawk.

Rather common in the eastern or wooded part of the province (R. H. Hunter). One fine specimen shot on Oak Hills, November 3, 1881 (Macoun).

111. *Buteo swainsoni*. Swainson's Hawk. Common Henhawk.

Very abundant summer resident in the prairie region. Very abundant 50 miles west of Pembina Mountains, at Turtle Mountain, and at Mouse River, along the boundary (Coues). Oak Point: 1884; arrived April 12 (Small). Winnipeg: Summer resident; abundant (Hine). Port-

age la Prairie; 1884; abundant; summer resident; first appearance in 1884, April 10; frequenting the open prairie and breeding in conspicuous places, usually in a small tree standing among low scrub (Nash). Carberry: Very abundant; summer resident; breeds perhaps twice each season; arrives middle of April, departs middle of October; near Brandon, Long River; near Turtle Mountain; in prairie region (Thompson). Two Rivers: 1885, first seen, one, on March 11; next seen, one, March 14; pretty common and breeds here (Criddle). Dalton: 1889, first seen, two, on March 22; next seen on March 23; is common, and breeds here (Youmans). Shell River: 1885, first seen, two, on April 9; afterwards seen nearly every day; it is common all summer and breeds here (Calcutt). Abundant on the prairies along our route (Macoun). White Sand River; May 4, 1884 (Christy).

Several times I have been guided to a hawk's nest by the old ones themselves, who, in their tremor of anxiety for their young, have flown half a mile or more to meet me, circling high above me and uttering those long piercing screams, with an intonation of distress that was unmistakable. On one occasion, while trapping Gray Gophers (*Spermophilus richardsoni*) at a teeming colony of this rodent, a hawk flew repeatedly over me and back and forth between me and an adjoining wooded slough. At first, I supposed I was trespassing on his hunting ground, especially when presently I saw him catch a gopher, and with it sail away so directly towards the trees that the inference of his nest being there was too palpable to be mistaken; I therefore followed him, and after a brief search discovered the nest in a low, dead poplar tree. Both old ones were screaming overhead, so that it was with certainty of a prize that I proceeded to climb the tree. As soon as my head appeared on the level of the nest, one of the three young ones escaped, a second could barely fly, yet it swooped out aslant into the scrub, 20 yards away. The third could not fly at all. Thus it seemed that they were of different ages. The nest contained one gopher. The two young birds were secured with little trouble; at first, the only defense they made was gaping silently, with feathers bristling and wings spread forward; but on my trying to tie their feet, No. 3 seized a forefinger in each claw and so held them till the blood trickled from two or three places; he only let go his hold when I spread his legs and brought my knee to bear on his breast.

Meanwhile the old ones were careering overhead, and on the back of the lowest was a kingbird, whose silent diligence and energetic application to the task of plucking the hawk was most amusing. He took several rides of over a hundred yards, and ultimately the hawk approached so near to me that she fell to a charge from the gun. This proved to be the mother. Her gizzard contained a Striped Gopher and part of a quail; the rest of the quail was in her throat, with one foot in her mouth; so full was she that I wondered how she was able to scream so much.

One of these young hawks was accidentally killed by a wagon, but the other throve in my hands and soon became reconciled to confinement in a barn, where in process of time he was joined by another of his own kind, a Peregrine Falcon, two Horned Owls and a Crane. Very soon the hawk evidently noticed a connection between my visits and his meals, and in a few days he learnt to greet me with an oft-repeated scream, much like that of the adults. His tameness increased until he would run screaming to be fed whenever he saw me. In a week or so more he could fly tolerably well, and was readily taught to come screaming and sailing about my head in response to the call, "Come, Dick." Then, after a performance of voice and wing long enough to give sufficient eclat to the forthcoming grand finale he would swoop past with the rapidity of at least a barnyard hen, and bear away my cap unless I held up in my hand a bird or gopher, which he never failed to truss. One foot only was used for small birds, usually his left, but if both gripped it was not at the same place, one foot being held far in advance of the other.

It is hard to say to what extent this bird might have been tamed, for during my absence for a week or so he reverted entirely to his original habits, and was thenceforth but little better than the wild kinsman that shared the building with him. The history of this latter bird is worth relating. I was looking out of the window when I chanced to see a hawk alight on a fence some 160 yards away; it was very conspicuous, having a white head. This aroused my curiosity to know what strange species it was. I took my rifle and by a wonderfully lucky shot, which I could not repeat for a kingdom, temporarily stunned the bird, the ball barely grazing its crown. It proved to be an old one, and its head was white chiefly behind and more or less streaked with brown. When it revived it was placed in the barn and seemed well enough, but refused all food, and for twelve days, so far as I know, it ate nothing. By this time it was reduced to a mere skeleton, but on the thirteenth day an idea seemed to dawn on it, and it made a hearty meal off a gopher, and continued well until one day the Horned Owls, its fellow captives, were left with insufficient provender, whereupon they killed the hawk and devoured it to make up the deficiency. On a later occasion poor Dick received a similar sepulture.

The brood from which Dick was taken, be it observed, was not able to leave the nest until July 24. I have several times found the bird with one or more eggs on May 20; have seen it setting late May and early June; on June 26 I found a nest with four eggs, nearly hatched; and again on June 28 I found one with young ones out and one egg not hatched. On August 8 I was led by a pair of old ones to the nest, which at that time contained only their youngest chick, then just able to fly a little. On the same day, in a different locality, I shot an old one which was carrying a meadow lark presumably home to feed its

young. So that these instances rather confirms the idea suggested by Dr. Cones, that this hawk may breed twice in a season.

As already indicated, the habits of this species are those of a Red-tail which has betaken itself to a prairie life, and in consequence its nest is in a lower situation and its flight less lofty, while it is also frequently seen sitting on the ground. For plowed fields, in particular, it manifests a partiality, perhaps because amid such surroundings it can most readily see and secure the gophers which constitute its principal food.

The nest of this bird is not peculiar. I have examined about fifty altogether, and have hitherto failed to find one that answers the published descriptions, which credit the bird with using a lining of hair and other fine material. All the nests examined early in the season were merely masses of sticks and twigs, with a slight hollow to contain the eggs, and had no special lining. But nests examined after the growth of the leaves—usually about the end of May—were more or less lined with twigs plucked with green leaves on them, and these when slightly wilted readily flatten down and form a wind-proof screen.

In general appearance this nest is much like that of the red-tail, but the position is different, being usually less elevated. I have seen many nests that I could reach from the ground. The favorite sites are the crown of a dense willow-clump, or the highest fork of a low scrub oak; occasionally I have observed the nest at a height of 20 or even 30 feet, in some poplar, but this is unusual.

The eggs are commonly three but sometimes four in number; they are more or less spherical and vary much in color. The young, when hatched, are the purest and downiest looking of innocents, and it is only on examination of the tiny though promising beak and claws that one can credit that little snowball with the "makings" of a ruthless and bloodthirsty marauder.

The diet provided for them by the old ones consists of animal food entirely; about 90 per cent. of it, probably, being gophers and insects, and the rest composed chiefly of young song and game birds.

The name henhawk is a misnomer as far as this species is concerned. All the hen lifting I have seen done in Manitoba was the work either of the peregrine or the goshawk.

August 5, 1882, near Badger Hill: On the way out here I got a fine buzzard; its crop was full of grasshoppers and mosquitoes. (Wood.)

112. *Buteo latissimus*. Broad-winged Hawk.

In Ontario it is essentially the hawk of thick foliage and densest forest; very rare; summer visitant. Winnipeg: Summer resident; rare (Hine). Fort Garry (Ridgway). Carberry: May 12, 1884, saw what I took to be a Broad-winged Buzzard; did not collect it; have not seen the species here before (Thompson).

113. *Archibuteo lagopus sancti-johannis*. American Rough-legged Hawk.

Migrant; common fall visitant. Less common in the spring. Winnipeg: Rare migrant; "have seen only three specimens in as many years;" 1884 (Hine). Carberry: Rare in spring; tolerably common in fall; Rat Portage (Thompson). Oak Point 1885; first seen, one, on April 7; next seen, April 8; became common on the 10th: breeds here? (Small). Portage la Prairie: Common in spring; abundant in autumn (Nash). Received both from Severn House and Trout Lake Station (Murray).

This bird is far from being common in Manitoba. On the Big Plain I have seen only about a dozen specimens, and of these about one-fourth were in the black plumage.

Throughout the Assiniboine Valley, so far as noted, it is found only in the spring and fall. It generally appeared in the neighborhood of Carberry when the nights began to be a little frosty. The earliest I have observed was on September 9. This was a black specimen; it was perched on the top of the tallest tree in a wet place on the prairie; when it saw me, 200 yards off, it flew with heavy, flagging flight straight to the next slough, where also it took its station on the highest available perch. This fairly represents the action of all that I have noticed; they are very shy and frequent the trees in the neighborhood of swampy places.

Common in spring; abundant in autumn. Sometimes very early in the morning, particularly if the weather should be cold and misty, I have seen a dozen or more of these hawks at one time sitting about on the fence-posts or on the broken ground in the most listless, dejected-looking manner possible. Having very seldom found anything in the stomachs of these birds, I fancy it is "a long time between meals" with them. (Nash, in MSS.).

114. *Archibuteo ferrugineus*. Ferruginous Rough-leg.

Probably Manitoban; Pembina Mountain at the boundary; breeding; early in July, 1873 (Coues). I have seen a specimen that was taken immediately to the west of the province (Thompson).

115. *Aquila chrysaëtos*. Golden Eagle.

Very rare; possibly resident. Winnipeg: Rare; apparently resident (Hine). Red River Valley: Very rare (Hunter). Portage la Prairie: 1884, very scarce; not seen by me (Nash). Big Plain (Thompson).

116. *Haliaeetus leucocephalus*. Bald, or White-headed Eagle.

Very rare summer visitant; probably breeding; frequent on Red River from Minehead to Pembina; several nests noticed (Coues). James Falls, Winnipeg River; eagles (Hind). Winnipeg: Summer resident; tolerably common; April to October 1 (Hine). Rare; "reported to be frequently seen on Lake Manitoba" (Nash). Mouth of Waterhen River, a pair; one at Cathead, Lake Winnipeg (Hind). Common between lati-

tude 62° and Lake Superior; at Cumberland House March 24 (Richardson). Qu'Appelle: Occasional; does not breed; April 30 (Guernsey).

The country west of the *Ouinipique* Lake has dry islands or hills with marshy bottoms full of wood and meadows. On the east side is a fine flat country full of woods until they come to the bottom of the mountains which are betwixt this and the upper lake. On a lake on that side, betwixt this lake and Lake *Du Bois*, are the *Migechichilinous*, or Eagle-eyed Indians; these, he says, are not called so from their having a sharp sight, but upon account of many eagles, which breed in islands of that lake. (Dobbs, p. 35.)

On an island near the mouth of the Waterhen River. * * * We found a pair of White-headed Eagles engaged in fishing, and as we came suddenly upon them after rounding a point, one of them dropped a fine whitefish he had just caught, which was immediately seized and appropriated by our men for their own breakfast.

On September 8, near Cathead Lake, Winnipeg, the party was reduced to great straits for provisions, when one chanced to shoot an old bald eagle. By eating nearly every portion of the animal, except the feathers, we managed to make him serve for two or three meals.) Hind. 1858).

Rare. On the 21st of March, 1885, Mr. T. A. Newman, of Portage la Prairie, showed me the wings of three of these birds that he had bought from an Indian, who said he had shot them south of the Assiniboine River. Mr. Newman also told me he had a year or two before shot one in full plumage on Lake Manitoba.

On the 25th of October, 1886, I saw a splendid bird in full plumage flying southward just over the trees on the bank of the Red River. (Nash, in MSS.)

117. *Falco rusticolus obsoletus* Black Gyrfalcon.

Probably Manitoban in winter. Has been taken in Minnesota a few times as a rare winter visitant; a specimen examined by Mr. Ridgway (Cooke). The inference from Hearne's narrative is that he also took this bird at Cumberland House, and if so it was probably of the same variety as those taken in Minnesota. Mr. Nash also reports seeing a supposed specimen fly over Portage la Prairie. This bird seems to follow the Willow Ptarmigan in winter; hence we would expect to find their southern ranges coincide.

They, like the other large species of hawks, prey much on the white grouse or partridge, and also on the American Hare, usually called here rabbits. They are always found to frequent those parts where partridges are plentiful, and are detested by the sportsmen, as they generally drive all the game off the ground near their tents; but, in return, they often drive thither fresh flocks of some hundreds. Notwithstanding this, they so frequently balk those who are employed on hunting service that the governors generally give a reward of a quart of brandy for each of their heads. Their flesh is always eaten by the Indians, and sometimes by the English; but it is always black, hard, and tough, and sometimes has a bitter taste.

The Indians are fond of taming these birds, and frequently keep them the whole summer; but as the winter approaches they generally take flight and provide for themselves. When at Cumberland House I had one of them, of which my people were remarkably fond, and as it never wanted for food would in all probability have remained with us all the winter, had it not been killed by an Indian who did not know it to be tame. (Hearne.)

The following from Hutchins seems to refer to this species:

It appears in these parts in the month of May, builds a nest with small sticks, feathers, and down, the two last plucked from its breast and lines the nest. It

chooses a lofty tree for its residence. The young brood are darker than the parents; they are commonly hatched about the latter end of July; it resorts to the plains and marshes. It is perpetually on the wing, skimming along the surface of the earth, and preys on small birds, plover, and ducks. (Hutchins MSS., Observations on Hudson Bay, 1872.)

Falco peregrinus anatum. Peregrine Falcon. Duck Hawk, or Bullet Hawk.

Much like the goshawk in movements and distribution; probably breeds in the neighborhood of large lakes. Winnipeg: Summer resident; tolerably common (Hine). Portage la Prairie; 1884, rare; saw two January 1, 1885 (Nash). Carberry: Common in the late summer and early fall; Boggy Creek, near Côté's, October (Thompson). Two Rivers: Bullet Hawk first seen, one, on April 4 (Criddle). Shot one at Côté's Reserve on the Assiniboine, September 22, 1880; I first watched it pursue and capture a Prairie Chicken (Macoun). Trout Lake Station and Severn House (Murray).

On August 11, 1882, about 10 in the morning, we had to drive away two Peregrine Falcons that were raiding in our poultry yard. In the afternoon they returned, and one of them made a most determined effort to secure a hen, despite two shots fired at him. However, he escaped unhurt after the second discharge. He did not stoop from aloft, but skimmed low over the ground in making his attack.

September 9, 1882. While standing behind the stable to day I heard the turkey give warning, and immediately there was a whizz and a gray streak past me in the air; the poultry screamed and scattered, and I whistled and shouted just in time to turn the stoop of a Peregrine. Again and again he dashed down and was with difficulty balked, and only by the time a gun was procured did he finally make off. Two days before I had found a hen with her head bearing three deep gashes, and I doubt not they were received from the claws of one of these marauders, though how many of our poultry they really took I can not say. I never saw any actually taken, and we never knew the exact census of the barnyard, so do not know how many, if any, disappeared.

On the morning of September 18, I saw a Peregrine sitting on the fence, but he flew before I could get a shot at him and circled away above the barn, increasing his elevation at each gyre until about at the third wheel, when at a height of 200 or 300 feet he suddenly stopped, half closed his wings, and dived headlong into a field half a mile away. His descent was at least as rapid as the fall of a stone would have been, and as he swooped his wings were slightly and slowly expanded and closed again a number of times. What his victim was I never knew.

On July 26, 1884, secured a Peregrine in first plumage. This was shot by Mr. Gordon Wright, near Carberry, and sent to me. He described it as the "swift gray hawk;" it was raiding in his poultry yard, when he ran with his gun to the rescue and rapidly fired, but the swiftness of the bandit saved him each time for four shots, and he

fiercely and determinedly continued to dash around the buildings in pursuit of the fowls, when a fifth shot grazed his wing and brought him down. He is the very personification of fierceness and defiance, and his actions are full of snap. As soon as approached he hissed, and struck with his great talons so quickly that the eye could not follow the movement. I put him in a building along with a Swainson's Buzzard and a crane, and, oh! how clumsy and vulgar they both looked beside him. He is the royalest robber that ever I saw. His every motion is so full of untamable ferocity as to elude the eye; his eye is brighter and fiercer than an eagle's, but I am in hopes that with care I may succeed in taming him. August 2: Notwithstanding the gentlest treatment, the Peregrine continued to scorn all approaches, and the slightest attempt to touch him called forth in response only the dim flash of his massive horn-tipped feet, a fair warning of what may be expected should the liberty of handling be attempted. On entering in the morning, I found him sitting on the body of the crane; it is not certain that he was the murderer, but it is against him, that having left him undisturbed for an hour immediately afterward he made use of the time to devour the greater part of the crane's breast on one side, and that he and the buzzard subsequently picked the bones clean. August 12: The Peregrine died to-day, after a captivity of three weeks, no cause being assigned for his death. He was a young male of the year, I think. Besides the hissing menace already mentioned, he indulged in two other vocal efforts; one an exceedingly loud, piercing scream of anger, the other a reiterated shrieking, almost exactly like that of the kestrel, but stronger and in a deeper key.

Pay-pay nay seu Ka cake. * * * They appear in our marshes in the beginning of June, and soon after make their nests in trees. It is composed of sticks and lined with feathers. They lay three or four white eggs. The young ones take flight in August, and the whole species leave us in September or the first week in October. They sometimes kill geese, but their usual food is ducks, plovers, partridges, and small birds. (Hutchins MSS., Observations on Hudson Bay, 1782.)

On September 11, 1883, at Carberry, about 4 p. m., a fine Peregrine came and sat on a fence close to the house. Just as I was about to fire at him with the rifle he rose and flew close over my head and around me. Then, after whisking over the chickens and putting them into a rare fright, he hovered for nearly a minute at about 40 feet above the ground as well as ever I saw a kestrel do, which surprised me. So stationary was he that I thought I might as well fire, as I had as good a chance of hitting him as on a fence. I did so, but of course missed him. (Christy, in MSS.)

119. *Falco columbarius*. Pigeon Hawk.

Chiefly in the migration; common. Dufferin: Arrived before April 15 (Dawson). Winnipeg: Summer resident; tolerably common (Hine). Ossowa: 1885, April 18; common April 23 (Wagner). Norway House (Bell). Common fall migrant at Carberry; noted also north of Petrel (Thompson). One shot at Livingston, September 13, 1881; common in Winnipegosis regions, breeding in the Assiniboine Valley, at Brandon,

and along the Qu'Appelle Valley (Macoun). Qu'Appelle: Tolerably common; arrives April 20 (Guernsey).

On September 9, 1883, a flock of five or six Pigeon Hawks came about the farm buildings. In general manners they were much like Sparrow Hawks, but they sailed more and flapped less. They were of course larger, and seemed more stoutly built; their duller color also was a distinguishing mark.

One trick of flight they had in common with the Whisky John, Shrike and others, namely, flying low over the ground towards a post or stump, and just as one expects to see them strike the bottom of it there is a sudden spreading of tail and wing, and the bird gracefully bounds straight up to the top and alights there. This species will sometimes hover, though they do not make such a practice of it as the Sparrow Hawks. This maneuver I have also observed, though in a still less degree, in the Peregrine. One collected was a female; length 12, extent 25. All above was dark brownish gray; all below, buff heavily streaked. Wings and tail show but few marks above; below are spotted with buff; in crop, a sparrow; in stomach, another. This band may have been a single family returning from their breeding place in the wooded mountains to the east.

120. *Falco richardsonii*. Richardson's Merlin.

Very rare. One taken at headwaters of Mouse River, Dakota, near the boundary (Coues). Shot at Fort Pelly in September, 1881 (Macoun).

121. *Falco sparverius*. American Sparrow Hawk.

Abundant summer resident; very abundant from Pembina along the boundary to the Rockies (Coues). One from between Hudson's Bay and Lake Winnipeg; one individual at Red River settlement on 22d April, in 1859 (Blakiston). Winnipeg: Summer resident; tolerably common (Hine). Oak Point: 1884, arrived April 20; 1885, first seen, one, on April 15; is common and breeds here (Small). Portage la Prairie: 1884, abundant summer resident; first appearance April 26, departing in October (Nash). Carberry: Abundant summer resident wherever there is large timber (Thompson). Very common; breeding along Red Deer, Swan, and Assiniboine Rivers; throughout the Winnipegosis region and in the various streams and valleys of the Northwest visited in 1880 (Macoun). Shell River: 1885, first seen, one male, on April 14; a transient visitant only (Calcutt). Qu'Appelle: Common; summer resident; breeds; arrives April 15 (Guernsey).

On July 26, 1884, while traversing the Carberry Swamp, I heard the loud, reiterated screeching of the kestrel, and on looking upwards saw one of these audacious birds following and dashing around an eagle, and endeavoring by every means in his power to intimate to the latter that his life was in imminent jeopardy—that, indeed, it was not worth a moment's purchase unless he instantly left the neighborhood

of his (the kestrel's) nest. When last I saw them over the trees, the eagle had apparently accepted the terms, and the kestrel was plying him with sundry sayings and maxims while he saw him safely out of his neighborhood.

In August they gather into small parties and hover about over the prairie, feeding principally on grasshoppers, though they are quite capable of capturing better game. On two occasions I have seen them kill and carry off meadow larks; these I shot in the act. Another time I found the remains of a red squirrel and a purple finch in the stomach of one, but the most extraordinary feat I ever saw one attempt was its attack on a crow. The hawk struck viciously at the crow, knocking him down into the road just in front of my house; the hawk dropped on the fence just over his intended victim, and sat there while the poor crow squatted close to the ground with his wings and tail spread out and mouth wide open looking the picture of terror. I had pulled up to watch the outcome of the performance, but unfortunately my horse moved and attracted the attention of the parties to the duel and they both flew off in opposite directions. The hawk could hardly have been driven to this bold act by hunger as it was late in the spring and there were numbers of small birds about.

Early in the morning of August 31, I saw a party of five or six of these hawks and a single Sharp-shin enjoying a regular romp around a deserted house on the prairie. They chased and dodged each other round and round the building, settling when tired on the roof and chimneys. The Sharp-shin took his turn with the rest in chasing and being chased, the whole game apparently being carried on in the most friendly spirit by all parties. I watched them for over half an hour and left them still at it. (Nash, in MSS.)

At Carberry on September 7, 1883: In the morning I found a considerable assembly of American kestrels (*T. sparverius*) round a small cluster of aspens about a mile north. I several times saw one of them chasing meadow larks, but with no success, apparently. At one time I got into quite a flock of them, twenty-five or thirty at least, and shot three, one fine old one, male, and two young ones both of which had only grasshoppers in their gizzards. All day they were round the house hovering and chattering just like the English kestrel, and sitting on posts and building quite tamely. I ran out of ammunition or could have shot lots, so tame and numerous were they. They must have some migration on hand as I have never before seen them so numerous, though sometimes I have seen single ones around the house. *

* * September 8. Kestrels are still about, but not in such large numbers. I shot another nice old male with plenty of grasshoppers and other insects in his gizzard. September 10. Kestrels are still fairly numerous about the premises and one was in the garden catching grasshoppers among the potatoes a good many times during the day. (Christy, in MSS.)

122. *Pandion haliaëtus carolinensis*. American Osprey, or Fish Hawk.

Rare summer resident; James Falls, Winnipeg River (Hind): Winnipeg: Summer resident; rare; Shoal Lake (Hine). Red River Valley: Summer resident; rare (Hunter). Common, nests along the Churchill and Grass Rivers (Bell 1880). Very rare; one seen over the Assiniboine River at Portage la Prairie, on May 11, 1885 (Nash). Saw it on the lakes behind Porcupine Mountain, and in the Winnipegosis region; saw nest in a tree on a rocky point (Wilkin's) Lake Winnipegosis (Macoun). Shell River: 1885; is a common summer resident and breeds here; first seen April 4; afterwards seen every day (Calcutt). Occasional summer resident at Qu'Appelle (Guernsey). Only observed once or twice (between Norway House and Carleton) (Blakiston).

123. *Asio wilsonianus*. American Long-eared Owl.

Tolerably common summer resident. Winnipeg: Summer resident; tolerably common; arrives April 1, departs November 1 (Hine). Solitary; hunts at night; Red River region (D. Gunn). Has been seen in the wooded country east of Winnipeg, during February (Hunter). "Screech Owl," Ossowa (Wagner). Portage la Prairie: Rare summer resident in this locality; near Winnipeg only five shot in six years (Nash). Carberry: Summer resident; not rare; breeding (Thompson). Two specimens procured at Fort Pelly, September 16, 1881, and one at Birtle, October, 1881 (Macoun).

On July 10, 1884, found a nest of the Long-eared Owl in the middle of a dense bush of low red willows. It was not more than 9 feet from the ground and yet very difficult of access, for the willow branches were too slender to bear my weight, and as they chanced also to be of dead wood they could not be bent down without endangering the nest. Therefore, to make close observations, I lifted a small boy on my shoulders, so that he was able to reach and hand me the contents of the nest.

The nest itself was composed entirely of sticks and was much like that of a hawk. It was not the old nest of a crow, or of any other bird that commonly builds with sticks, so that I am satisfied that it was the owl's own work. At this time it contained four young ones, and these were evidently of four different ages, one being half-grown and nearly fledged; another seemed to be only two or three days old, for it was yet a tiny ball of white down that the elder one might easily have swallowed. The others were in different stages between these. Each of the nestlings as it was handled snapped its bill with vigor proportioned to its size. The mother bird had appeared soon after we arrived, and although it was a bright summer day, she did not seem to be at all inconvenienced by the light, but flew around us with all the assurance of a bird that is usually diurnal.

When we approached the nest she became much excited and either flew round and round us or alighted close over our heads, and snapped her bill loudly and often, while from time to time she uttered a loud long cry like "*on-il-il-il-il-il-loo*."

Having completed my examination I left her in peace, intending to return again in a few days to note the growth of the birds; but some one came before me, and when next I went the nest was empty.

On the night of August 25 I heard a strange shrieking, between the cry of a fox and a cat. It seemed to come from the barn where my Horned Owls were confined. I took my gun and went out. After waiting and watching for some minutes I made out the form of a large broad-winged bird, flying around the building and uttering the wild sound I had noted, in response to the querulous notes of the owls within. When I mimicked its note it flew over me, and was at once

“collected.” It proved a Long-eared Owl. The long note that I heard from this owl is decidedly musical, but the cries heard at this time may be best described as unpleasant shrieks.

Amisk-oho or Long-eared Owl of Pennant. This species is found, though not frequently, at Severn Settlement. * * * They inhabit the woods at all seasons, a considerable distance from the sea; seldom to be found within the day, but in the night approach, when a clamorous noise proceeds from tents. They breed in trees, lay four white eggs of an elliptical form in April, and their young fly in the latter end of May. N. B.—This bird is local. (Hutchins MSS., Observations on Hudson Bay, 1782.)

Have never seen them in the winter. They always disappeared at about the time the first snow fell, with the short-eared species. Their flight when hunting during the day always reminded me of the harrier, which it closely resembles. (Nash, in MSS.)

124. *Asio accipitrinus*. Short-eared Owl. Marsh Owl.

Tolerably common, chiefly in early autumn; probably breeding. Winnipeg: Summer resident; tolerably common; arrives April 1, departs November 1 (Hine). Portage la Prairie: Abundant summer resident; most often seen in the fall, especially about the marshes in August and September; never seen in winter; arrives early in April, departs late in October (Nash). Carberry: Not uncommon in August and September (Thompson). Brandon: April 18, 1882 (Wood). Abundant on Western Plain, 1880; two specimens procured on Assiniboine River below Shell River, September 24, 1881 (Macoun). Trout Lake Station (Murray).

August 18, 1883. During the month we have often seen owls that appear just about dusk and winnow over the prairie to the west of the house; now high and sharp against the last bright streak of day; now down, to remain lost against the dark earth; and if again rising after some time from that same place, we know that pounce brought death and burial to some foraging field-mouse or dissipated small songster. I suspect that this species is either the Long-eared or Short-eared Owl. This evening one of these mouse-hunters came careering about the barns with evident intent to dabble his very soul in arvicoline gore. Mr. Christy's gun was ready and he had one snap shot, but the owl flew off to the northwest over the grain field, but lower we thought as he disappeared. Night and a rainstorm came together and prevented our following.

August 19. A heavy rainstorm all day.

August 20. This morning the rain ceased. About 10 o'clock we went out in the direction of the owl's course. We had almost persuaded ourselves that we saw the bird go down by an old strawstack far out in the field; so on the mere chance we went to this place, and almost immediately up sprang the owl, but at once he was “collected” by the aid of the ready double-barreled, and there he lay on the grass, a beautiful specimen of the Short-eared Owl. His plumage was in perfect order and his horns were remarkably prominent; this, however, was lost

after he had been handled. The curious circumstance of this incident is the owl's persistently remaining during a forty-hours rainstorm on this bare open place while powers of flight were unimpaired, and his only injuries apparently a slight flesh wound on the wing. I have noted several similar instances among hawks and owls.

This specimen was: Length, $14\frac{1}{2}$; weight, 10 ounces; wing surface, 162 square inches, or $16\frac{1}{2}$ to each ounce of weight. In its stomach was a single large brown cricket (*Udeopsylla nigra*), no doubt captured on the ground where we found him.

The short-eared owl is a great friend of mine; he turns up regularly every August and September in the marshes and meadows both in Ontario and Manitoba, but I have never seen them in the spring or summer, and as I spend most of my time during the year in their favorite haunts, and never see them nesting or about, am strongly inclined to think they do not breed in the province, nor do they stay during the winter.

On the 18th of April, 1885, at sunset, a large number of these birds came out of the marsh and quartered about over the prairie. One of them, however, after a time rose high in the air and played about over a slough much after the manner of a Night Hawk. I believe it was catching on the wing some of the aquatic beetles that were rising from the water at the time.

Early in the morning of the 25th of April one of these owls circled round my blind for some time, frequently striking its wings together over its back, producing a loud snapping noise. The same bird several times perched on a fence rail near me, this being the only time I ever saw one alight on anything higher than a muskrat house or a log imbedded in the mud. (Nash's MSS.)

125. *Syrnium nebulosum*. Barred Owl.

Rare and probably migratory. Winnipeg: Summer resident; rare; arrives April 1; departs November 1 (Hine). Red River Valley: Tolerably common in the wooded country east of Winnipeg, where it has also been seen in February (Hunter). Was shown the wings of one shot near Rat Portage in the fall of 1886 (Thompson). Portage la Prairie: Very rare, only one seen near the Assiniboine, but I have occasionally heard them hooting in the woods on the bank of the river in August (Nash).

126. *Ula cinerea*. Great Gray Owl.

Rare winter visitant; one in Smithsonian Institution from Red River Settlement (Blakiston). Found along Red River and at Lake Winnipeg as a winter visitant, but not common (Hine). Carberry: One taken September 29, 1884 (Thompson).

On September 29, 1884, received from George Mersham a fine Gray Owl which he had shot in the woods to the south. It was a young male; length 25, extension 54; weight, 26 ounces; wing surface, 480 square inches, *i. e.*, $18\frac{6}{13}$ to each ounce of weight, nearly twice that of the turkey vulture shot yesterday; tail surface 100 square inches. In a remote corner of its spacious stomach I discovered a tiny shrew (*Sorex cooperi*?) and the rest of this capacious receptacle was unoccupied.

127. *Nyctala tengmalmi richardsoni*. Richardson's Owl.

In the wooded sections probably resident. Winnipeg: Winter visitant; tolerably common; probably resident (Hine). Selkirk Settlement in February and March (D. Gunn). Two Rivers: On February 7, 1885, shot a pair of Richardson's Owls (Criddle).

On June 11, 1883, at the spruce bush I found the remains of a specimen of Richardson's Owl. This was shot in the spring by one of the mill hands and left where it fell.

February, 1885, Toronto: While at Winnipeg last month Mr. Hine showed me several dozen specimens of this bird, all taken near the city within three months.

128. *Nyctala acadica*. Saw-whet Owl.

Rare, resident. Noted only on Red River: Rare; probably resident; only two seen at Winnipeg up to 1884 (Hine). Red River Valley: Resident (Hunter).

Shipo me shish: Small Owl. This is the smallest owl in Hudson Bay nearly, corresponding to the small owl of Pennant. It weighs $4\frac{1}{2}$ ounces, the length $8\frac{1}{2}$ inches, the breadth 20, irides bright yellow; feet and legs feathered, and talons black. * * * It lives among the pines in all seasons, feeding on mice; only builds a nest of grass half way up a pine tree in the month of May, lays two white eggs, and the young fly in the beginning of July. They are not plenty and are the most solitary bird I ever knew, seldom moving in the daytime, but a brisk mouser by night. They never change color. It is common for the Indian children to steal toward them in the daytime and seize them. (Hutchins MSS., Observations on Hudson Bay, 1782.)

Mr. Hunter claims the Screech Owl (*Megascops asio*) for Manitoba, saying: "I saw a pair at Saboskong Bay, Lake of the Woods, and in 1871 heard them at Point du Chene."

129. *Bubo virginianus subarcticus*. Western Horned Owl.

Common resident wherever there is timber. This form of *Bubo* is lighter in color than the true *Bubo virginianus subarcticus*. It is probably just intermediate between that form and var. *arcticus*. Pembina: Breeding (Coues). Winnipeg: Common resident throughout the year (Hine). Red River Valley: Permanent resident; more seen in winter (Hunter). Swampy Island: 1885; common resident; breeds near here (Plunkett). Observed breeding (Wagner). Portage la Prairie: Common resident but somewhat migratory (Nash). Carberry: Common resident; breeding; Rat Portage; Duck Mountain; Assissipi (Thompson). Two Rivers, November 12, 1885 (Criddle). Shell River: 1885; winter visitant (Calcutt). Fort Ellise: October, 1880 (Macoun). White Sand River: May 5, 1887; nesting (Christy). Qu'Appelle: Occasional; not common (Guernsey).

September 18, 1884, Portage la Prairie: Mr. C. W. Nash gives me a very interesting note on a pair of Horned Owls that had nested in the woods here, and from the indications observed there seems little

doubt that they subsisted chiefly on fish, which were abundant in a small creek running from a lake through these woods to the Assiniboine River. On examining the gizzards of two of the young of this pair which Mr. Nash shot, he found them full of fish. At one place there were, unquestionably, evidences of an owl having seized a large fish with one foot and held on to the bank with the other. The creek being very small, and surrounded with large bare trees, is a favorite run between the river and the lake for large fish at night, so that all the circumstances are very favorable for the prosecution of the piscatorial pursuits of the owls.

On the 8th of May, 1884, I found a pair of these birds in possession of an old nest in the Big Swamp on the Assiniboine River, south of the Big Plain. This nest was about 30 feet from the ground, in the crotch of a poplar tree, which was as yet without leaves. The nest was formed of sticks and twigs and was indistinguishable from that of a Red-tailed Buzzard. Once or twice I tried to shoot the old bird on the nest, but she was too wary, and evidently had all her wits about her even in the day time. On the 15th of the month I returned to the nest, determined to bring home whatever might be in it. Arriving at the place we found the old birds were absent, so I stood with the gun to watch, while Dr. Gilbert, who accompanied me, climbed the tree. He had not got half way up when the old ones made their appearance, skimming about among the tamaracs and hooting "*who-who-are you.*" As the danger to their brood increased they came nearer and nearer, shouting and stammering with rage "*who who who-are-you?*" "*What-do-you-do?*" "*Up a tree.*" Then, having learned it seemed, from their close inspection, the magisterial function of the climber they wheeled off, snapping their bills and groaning aloud "*Oh-h h-h J P up-a tree!*" And stricken by the hopelessness of their case in this new aspect, they dashed about shouting hoarsely "*Oh-h h,*" "*Go down,*" "*Do go down,*" "*Oh-h-h —,*" and as one of them recklessly flew close to me, I fired and it fell. This proved to be the female; she measured 53 inches across the wings and in length 25 inches. Her stomach contained part of a partridge. In color she was as light as young females of the Snowy Owl. In the nest were three young owls, two dead partridges (*Bonasa*), and a hare; one of the partridges had in her an egg ready for exclusion, excepting that the shell was as yet pure white without any spots. •

The young ones appeared to be about three weeks old. The largest weighed 1 pound 5 ounces, and was about the size of an ordinary pullet. One of them was but half as large as the others. All were clad in white down, with the rudiments of black and white feathers showing in the wings and on the back. Their horns were plainly visible in the form of down tufts.

They resented in the orthodox manner the liberty taken in removing them from the nest, snapping their bills and hissing in a way that

would have distinguished much older birds; but as they did not attempt to use their formidable talons, we did not suffer much inconvenience from their menaces. One of them had been injured, and died before we reached home, the others thrived and readily ate from our hands from the first. They solicited food by a short scream very like that of a Night Hawk; they menaced by snapping their bills and hissing, and expressed surprise and anger by a querulous whistle.

By the time they were about two months old they were fully fledged and could fly fairly well. In general color they were pale buff with black bars; a little lighter than the typical *Bubo virginianus*, but considerably darker than the mother. At this time the horns were less conspicuous than when in the down.

They ejected a pellet about five times per week, and if supplied with more food than required for present use they hid it until they were hungry.

At first we (Dr. Gilbert and myself) were in hopes of taming them, but their ferocity grew with their growth, and when they were able to fly, so far from submitting to be handled it was not safe for a stranger to come near them. No better illustration of their strength and fierceness could be given than the fact that, on one occasion, when they were left without food for a longer time than usual, they killed and ate a fine full-grown Swainson's Buzzard, which was confined in the same barn with themselves; and subsequently they did the same with another bird of the same species, which I had always thought strong enough and quick enough to take care of himself.

At the age of 10 weeks a perceptible change in their plumage began to take place; the buffy feathers of the breast gradually giving place to the pure white of the old birds, amounting almost to a transition from the *B. virginianus* form to that of the *B. v. arcticus*.

They continued to grow until they were nearly 6 months old. Their appetites were large and very fastidious, for they would eat half a pound of meat per day each, and would relish only such as was perfectly fresh.

Towards the end of October they seemed to have ceased growing and were contented with smaller rations; their horns were fully developed; they had made their first attempt at hooting, and otherwise manifested their conviction that they now were able-bodied owls on their own account.

In November I was so much from home that they did not get more than 3 meals per week, and it was useless to give them a large quantity of food at a time, as it froze to a stony hardness in a few minutes; therefore, as I could not feed them properly, I thought it better to kill them. When the first was quieted, he proved on examination to be excessively fat, notwithstanding his month on short allowance. Under these circumstances sentence on No. 2 was commuted. However, a storm tore open his house; he escaped, but continued about the build-

ings, which were 2 miles from the woods. After a month of this life, during which he received no food from me, I shot and found him, not starving as I expected, but fully as fat as his brother had been.

My ample opportunities of fully observing these interesting birds in captivity as well as in a state of freedom, and indeed all that I have seen of them—their untamable ferocity, which is daily more apparent; their magnificent bearing; their objection to carrion, and strictly carnivorous tastes—would make me rank these winged tigers among the most pronounced and savage of the birds of prey.

Natow okey ornis seu: Horned Owl. This elegant bird harbors in the woods, feeding on mice, wild fowl, and carrion. About the middle of March it builds a nest in a pine tree, with a few sticks laid across, and lays two whitish eggs; the young ones take to the wing in June. (Hutchins MSS., Observations on Hudson Bay, 1782.)

Common resident; but I am satisfied this bird is somewhat migratory, as there is always for sometime in the fall a large increase in their number; at the approach of winter they become less numerous. I noticed this every season. They are almost abundant in October on the Red River, four or five being seen by me nearly every day; after the cold weather set in the great majority of them disappeared.

They vary much in plumage, ranging from very dark to extremely light-colored specimens; two young birds I shot August 9, 1884, being the two palest I have ever seen anywhere. Another bird that was with these two appeared quite dark beside them. (Nash, in MSS.)

129a. *Bubo virginianus arcticus*. Arctic Horned Owl.

One shot near Duck Mountain in the fall of 1883 (Thompson). Touchwood Hills: October, 1880 (Macoun).

130. *Nyctea nyctea*. Snowy Owl. White Owl.

Tolerably common winter visitant. Winnipeg: Winter visitor; tolerably common; arrives September 20, departs April 20 (Hine). Merely a winter visitant in the districts to the west of Lake Winnipeg; a few pass the summer near Lake Winnipeg, as occasional birds are seen there in spring and fall (D. Gunn). Ossowa (Wagner). Portage la Prairie: Regular winter visitor, appearing in varying numbers each season (Nash). Carberry: Regular winter resident; Melbourne, Boggy Creek, Big Plain (Thompson). Brandon: February 22, and a female on March 5 (Wood). Qu'Appelle: Have seen specimens, but not common (Guernsey).

Wa-pa-cu-thu, or Spotted Owl. * * * This bird is an inhabitant of the woods; makes a nest in the moss on dry ground. (Hutchins MSS., Observations on Hudson Bay, 1782.)

During the winter of 1882-'83 they were very common. I saw some almost every day; two or three perfectly white ones amongst them. In the winter of 1883-'84 they were less numerous; in the winter 1884-'85 very few were seen; the same in 1885-'86 as in the last three mentioned years; hares were extremely abundant in the north; they probably found sufficient food to maintain them there; arrives in October, departs in February or early in March. (Nash, in MSS.)

131. *Surnia ulula caparoch*. American Hawk Owl.

An irregular winter visitant. Winnipeg: Winter visitant; arrives in September, departs in April; very abundant in winter of 1884-'85 (Hine). Red River Valley: I am positive that it is a permanent resident and breeds in the wooded country east of the Red River (Hunter). Winter resident; very common at Riding Mountains fall and winter, 1884; not noted at Portage la Prairie (Nash). Carberry: Very abundant in the fall of 1884 (Thompson). Cumberland House, May, 1827 (Richardson). Trout Lake Station and Severn House (Murray).

On October 18, 1884, while shooting in the half open country to the south, I saw a Hawk Owl. Its flight was much like that of a Pigeon Falcon, and it perched after each change of position on the very top of a tree. I winged it at the first shot, and having heard that this species use their beak and claws energetically when wounded, I approached with due caution. It hissed once or twice and endeavored to escape by hopping. After some little handling it attempted to bite, but did not otherwise defend itself. October 28: The Hawk Owl seems to thrive very well in confinement, and during the past ten days I have had no occasion to accuse it of any approach to viciousness. It has often been handled and if hurt thereby simply expresses its annoyance by a chuckling note, much like that of a Whiskey John. When placed on the ground it progresses rapidly by great hops, but the slightest puff of wind is enough to upset it. It sometimes utters a rolling "whill-ill-ill-ill-loo," somewhat like the cries of the Long-eared Owl. It has never sulked, but from the first has been ready to apply itself to the demolition of the small birds and mice with which it has been supplied.

On November 7, while at the poplar bush, I saw several Hawk Owls and secured one alive. This one is as different as possible in temper from the first I had. It snaps with its bill and strikes with its claws at any person or animal that approaches it. It refused all food and continued sulking till it died.

This fall has been remarkable for a migration of Hawk Owls. During the autumn of 1882 and 1883 I saw not one about here, but this year I have seen above fifty. Its favorite localities appear to be the half-open woods and park lands, and it is usually seen perched on the top of the bushes and trees. In passing from one tree to another, it commonly throws itself headlong downwards nearly to the ground, along which it skims towards the next tree, and on nearing its goal rises with a graceful aerial bound to the topmost perch offered.

Somewhat irregularly distributed throughout the province. Near Portage la Prairie I never saw it, but in December, 1884, I met with it in gradually increasing numbers from Gladstone to the Riding Mountains, where it was very common. They are quite diurnal in their habits. Two that I shot had nothing in their stomachs. Its flight, particularly through the low bushes and scrub, closely resembles that of the Sharp-shinned Hawk; it skims along noiselessly close to the ground, frequently alighting on the top of a bush, from whence it will dart on a mouse or other prey. It also frequently rises high in the air and hovers over the ground, remaining sta-

tionary over one place for some time, exactly like a kestrel or our own Sparrow Hawk.

On November 26, 1886, I saw one on the banks of the Red River. (Nash, in MSS.)

132. *Coccyzus erythrophthalmus*. Black-billed Cuckoo.

A tolerably common summer resident in woodlands. Breeding in Pembina Mountain (Coues). Red River Settlement (Brewer). Winnipeg: Summer resident; tolerably common (Hine). Oak Point: 1884, arrived June 1 (Small). Portage la Prairie: Tolerably common summer resident; arrives about June 1, departs in August; not observed on the Red River near Winnipeg; in 1884, first seen May 31 (Nash). Carberry: Tolerably common summer resident; noted near Shoal Lake, west, and eastward toward Rapid City (Thompson). August 29, south slope of Riding Mountain, American Cuckoo observed (Hind, 1858). Shell River; 1885, first seen, two, on June 16; is common all summer and breeds here (Calcutt). One shot on Moore Mountain July 3, 1880 (Macoun). Qu'appelle (Guerney).

On July 29, 1882, at Carberry, while out in the woods to the east, I heard the sonorous and to my ear pleasing "*kow-kow-kow*" of the Rain Crow or Black-billed Cuckoo, the first I have heard in the country. This specimen measured: Length $11\frac{1}{2}$, extension $15\frac{1}{2}$; its stomach was filled with vegetable matter and the remains of insects.

On August 13, at Carberry, shot a cuckoo (*erythrophthalmus*) in the afternoon; male; length 11, extension 15; stomach was crammed with caterpillars and grasshoppers; its inner coat seemed to be very slightly covered with minute hairs. Several of the species were seen.

On June 23, 1884, near Shoal Lake, returning with A. S. T. from Duck Mountain, for the first time noted the cuckoo. The sonorous "*kow-kow-kow*" came again and again from a little grove of poplars on the prairie. I went towards it and presently heard it behind me, and after a little more searching I discovered the bird on a branch about 5 feet from the ground and 10 from where I stood; it was sitting perfectly motionless, watching me closely, and deliberately uttering the characteristic *kow-kows*, varied with other sounds of the same nature.

These notes have often been described as hard and disagreeable, but to my ear they are not unmusical and are full of associations with forest life and odors that make them pleasing to my mind.

(On the succeeding days of June, I found this species quite abundant in the groves on the prairies between Shoal Lake, west, and Carberry.)

133. *Ceryle alcyon*. Belted Kingfisher.

Common summer resident along all fish-frequented streams and lakes; of general distribution; Pembina and Mouse River (Coues). Pembina, May 1 (Blakiston). Dufferin: Arrived between April 25 and 30 (Dawson). Winnipeg: Summer resident; tolerably common (Hine). Swampy Island: 1885, first seen, one, on May 18; next seen May 19,

after which it became tolerably common; breeds here; in fall was last seen on September 24; 1886, first seen, one, on April 29; bulk arrived May 15; last seen May 22; is rare here (Plunkett). Specimen in Smithsonian Institution from between Hudson's Bay and Lake Winnipeg, also from Red River Settlement, Pembina, May 1, (Blakiston). Lake Winnipeg (Bell). Shoal Lake, May 15, 1887 (Christy). Portage la Prairie: Common summer resident about the streams and lakes; arrives early in May; commences nesting about the 15th of the month; departs in October; in 1884, first seen May 5 (Nash). Very abundant on Red Deer, Swan, Assiniboine, and all rivers along route of 1881 (Macoun). Carberry: Summer resident; more seen in springtime (Thompson). Dalton: 1889, first seen, one, on April 29; moving unsettled; rare here and not breeding (Youmens). Shell River: 1885, first seen, one, on May 1; next seen, one, on May 3; a transient visitant; not breeding (Calcutt). Qu'Appelle: Tolerably common summer resident; breeds; arrives May 30 (Guernsey).

I have never seen this species in the vicinity of any of the drainage lakes, although they abound with amblystomæ, insects, etc., to the exclusion, however, of fish.

134. *Dryobates villosus leucomelas*. Northern Hairy Woodpecker.

Common resident of the woodlands. In heavy timber on Turtle Mountain (Cones). Winnipeg: Rare; breeding (Hine). Portage la Prairie: Tolerably common resident (Nash). Touchwood Hills and Lake Manitoba, and northward, 1880; in the woods along the Red Deer and Swan Rivers, 1881 (Macoun). Carberry: Common; breeding; probably resident, but not observed by me in the very coldest weather. Rat Portage: Tolerably common (Thompson). Qu'Appelle: Tolerably common; permanent resident (Guernsey).

On June 11, 1883, while in the spruce bush, I heard a curious chirping sound that scarcely ever seemed to cease. I traced it to a tall poplar tree, in whose trunk there was a hole about 30 feet from the ground. Having procured an ax I soon had the tree down, and found myself in possession of a nest of young Hairy Woodpeckers. They were in a hole, evidently the work of the parent birds, about a foot deep, 3 inches wide inside and 2 at the entrance. The four youngsters were nearly grown and fledged, and consequently were much crowded in this narrow chamber. Three of them were precisely like the mother-bird in color and the fourth differed only in having over each ear a cockade of rich yellow. I took them home with me and found that they had enormous appetites, nearly unlimited capacity, and tremendous lung power. The whole day long, when not eating, they kept up a deafening *chirr-chirr-chirr*, and two of them, including the yellow-topped one, never ceased, except in absolute darkness. Even while morsels of food were passing down their greedy throats they would continue to gurgle out a sufficiency of interrupted *chirr-chirrs* to save the principle. I found that at one meal

each of these birds could take 2 feet of the entrails of a duck. I did not find it convenient to feed them more frequently than three times a day, and each meal-time found them ravenous, so that probably the parents provided them with much more food in the aggregate than I did, and as all they brought them would probably be maggots and insects, caught singly, we may form some idea of the enormous labor entailed by the rearing of a young brood. These young birds have at each corner of their mouths the usual boss or rounded mass of yellowish white tissue. I have never been able to decide on the use of this. I had supposed that it is intended to widen the gape, as it is largest in the newly-hatched bird, but is gradually absorbed as they grow. Experiments, however, with these young woodpeckers led me to believe that the nerves of taste, or at least of touch, are located there, for these birds never would open their beaks to receive the food they were clamoring for at first when I touched them on the beak or breast, but the moment this soft lump was touched they were wide agape.

The usual note of this rather noisy bird is a loud *chuck*, but it has also a harsh, prolonged, rattling cry, somewhat of the nature of the kingfisher's rattle, but varied and lengthened with a combination of stridulous screams.

135. *Dryobates pubescens*. Downy Woodpecker.

Tolerably common in wooded sections; said to be resident. Winnipeg: Resident; abundant; breeding (Hine). Shoal Lake, May 15, 1887 (Christy). Ossowa (Wagner). Portage la Prairie: Tolerably common resident (Nash). Lake Manitoba and westward; specimen shot at Manitoba House, June 16, 1881 (Macoun). Carberry: Uncommon; probably resident (Thompson).

136. *Picoides arcticus*. Arctic Three-toed Woodpecker.

Common resident in the woods, especially among spruce. Specimens procured near Red River Settlement by D. Gunn in Smithsonian Institution collection (Blakiston). Very abundant about Rat Portage in October, 1886; also in all the spruce woods near Carberry; it is there more numerous in winter than in summer, therefore it may be partly migratory (Thompson). Specimens shot at the confluence of Red Deer River and the Etimoines River (Macoun).

On November 4, 1884, while out deer-hunting, I was guided by the tapping and "churking" of a Three-toed Woodpecker to the place where he was busy foraging on the trunk of a spruce tree, and although I scored a clean miss the bird fell dead at my feet without a sign of violence about it. It was a female and the stomach contents, as identified by Dr. Brodie, are as follows: Eight larvæ of a *Buprestis* (a spruce borer); five larvæ of another species of *Buprestis*, five larvæ of a *Saperda* (a pine borer); one larva of a *Lepidopter*, probably a moth; one larva not distinguishable, and a small quantity of wood.

137. *Picoides americanus*. American Three-toed Woodpecker.

Very rare, but probably general in the north and east. Winnipeg: very rare (Hine). I have taken this bird on the Brokenhead River, also on the Winnipeg (R. H. Hunter). Rat Portage, October 21, 1886, saw what I took for *Picoides americanus* (Thompson). This bird exists in all the forests of spruce-fir lying between Lake Superior and the Arctic Sea, and it is the most common woodpecker north of Great Slave Lake (Richardson). Severn House (one specimen), the common Three-toed Woodpecker (Murray). Hudson's Bay (Hutchins).

138. *Sphyrapicus varius*. Yellow-bellied Sapsucker.

Common summer resident of wooded section; plentiful at Pembina, where it was breeding in June; again seen on the Mouse River; not observed further north (Cones). Winnipeg: Summer resident; abundant (Hine). Shoal Lake: May 20, 1887 (Christy): Abundant around Lake Manitoba and westward; specimen shot at Manitoba House, and Swan Lake House, June and July, 1881 (Macoun). Carberry: Common summer resident; breeding (Thompson). Shell River: 1885, first seen a pair on May 3; a transient visitor; not breeding (Calcutt).

On June 20, 1883, at the spruce bush, I found the nest of a Sapsucker. It was in a new hole in a green poplar tree, about 30 feet from the ground. It contained five newly hatched young, and in the chamber with them were some of the shells, out of which I reconstructed two eggs. The male, length $8\frac{1}{8}$, stomach full of ants, the female, length $8\frac{3}{8}$, stomach full of ants, her bill also, was full of black ants, intended probably as food for the young ones, excessively fat, no red feathers at all except three or four scattered on the front of the crown, which was black. The eggs were each $\frac{1\frac{3}{8}}{1\frac{1}{8}}$ by $\frac{5}{8}$ and pure white.

On July 3, in spruce bush, with M. C. found the nest of a Sapsucker. It was about 20 feet from the ground in a poplar, and facing the southeast. Just over the hole was a large limb, which would doubtless be of some service as a shelter from the rain. I shot the female; her crown was black, with but a very few red feathers in the front, and some of these were tipped with yellow. The gizzard was full of wood ants (*Formica rufa*).

139. *Ceophloeus pileatus*. Pileated Woodpecker. Cock of the woods.

Rare; resident in heavy timber. Winnipeg: Summer resident; tolerably common at Lake Winnipeg and Lake of the Woods (Hine). Selkirk (Gunn). Swampy Islands: Tolerably common resident; breeds here (Plunkett). Nelson River (Brewer). Very rare summer resident; saw one that had been shot in the woods near the White Mudd River at Westbourne in 1887 (Nash). The species was seen on Swan River, September 2, 1881 (Macoun). Common in the woods between Wanni-

peg and Rat Portage, also about Lake Winnipeg in the spruce woods (Dr. Arthur S. Thompson). Mr. Hine showed me a specimen taken at Prince Albert; two seen at Rat Portage (Thompson).

On October 16, at Rat Portage, a Pileated Woodpecker was shot by W. S. Thompson; male; length $18\frac{1}{2}$, extent 29; stomach full of ants. In the afternoon saw another in an elevated piece of burnt woods.

There is another species of Woodpeckers, the size of a migratory pigeon, with a blooming crimson crown. They inhabit the interior part of Hudson's Bay. The skins of their head are used by the trading natives to ornament their calimats. Also describes a specimen. It was shot in January at Gloucester House in latitude $50^{\circ} 31' N.$, longitude $96^{\circ} 3' W.$, and 387 miles up Albany River. Makes a nest in the holes of trees; lays six eggs and brings forth its young in June. (Hutchins MSS. Observation on Hudson Bay, 1782.)

140. *Melanerpes erythrocephalus*. Red-headed Woodpecker.

Rare summer resident; common at Pembina (Coues). Winnipeg: Summer resident; tolerably common; one or two pair seen each season (Hine). Very rare summer visitor; May 31, 1885, saw one bird near the town (Portage la Prairie) and a day or two afterwards saw the same bird or another near the same spot (Nash). Carberry: Rare; summer resident (Thompson).

Red-headed Woodpecker. * * * This bird is uncommon in these parts (Albany), as I conclude from the ignorance of the natives in general concerning it. Perhaps this is the farthest part of its migration. (Hutchins MSS., Observations on Hudson Bay, 1782.)

141. *Colaptes auratus*. Flicker. Highholder. Golden-winged Woodpecker.

Very abundant; summer resident wherever there is timber; common along Red and Mouse Rivers; also observed at Pembina and Turtle Mountains (Coues). Dufferin: Arrived between April 15 and 20 (Dawson). In a Selkirk Settlement specimen the belly is tinged with pale sulphur yellow, the back with olivaceous green (Ridgway). Winnipeg: Summer resident; abundant (Hine). Nelson River: In immense numbers at Red River Settlement, April 26, 1859 (Blakiston). Ossowa: Breeding (Wagner). Oak Point: 1885, first seen, one, on April 21; next seen on 22d; is common and breeds here (Small). Portage la Prairie: Abundant; summer resident; arrives about April 20; departs early in October (Nash). Common throughout the Winnipegoses region and along the Assiniboine wherever there were trees; Red Deer Lake, August 20 (Macoun). Carberry: Abundant; summer resident; breeding; Rat Portage (Thompson). Dalton: 1889, first seen, one, on April 12; next seen, April 13; became common on April 15; breeds here (Youmans). Shell River: 1885, first seen, two, on April 27; afterwards seen every day; is common all summer, and breeds here (Calcutt). Qu'Appelle: Common; summer resident; arrives April 25 (Guernsey). Trout Lake: One of the woodpeckers, but, as it feeds on ants and therefore does not require so much labor to get

its food as the other woodpeckers, its bill is less suited for such work; it is only a summer visitant to the fur countries (Murray).

On May 31, 1883, found a Flicker's nest in oak stub, only 8 feet high; the hole was 18 inches deep, but the wood was quite rotten, and I had no difficulty in reaching the eggs.

October 27, 1882, while examining an old stump in the woods to the north of Carberry, I met with an excellent illustration of the aptitude of the Spanish name for the woodpecker, "El Carpintero," as applied to our Flicker. I mean in the sense of its being a worker in wood and house provider for others. The history of the case was briefly this, as far as the circumstantial evidence revealed it: First came the hard-working Flicker and excavated the hole, perhaps while yet the stump was sound, and in the years that followed we know not how many young Flickers cracked their glass-like shells in this narrow chamber; and after the Flickers came no more it was taken by some bird, a grackle perhaps, that, like the "foolish man," founded its nest on mud, finishing its superstructure with sticks and straw. Then, it seems, came a new possessor, who built a strong, shapely nest of moss and mud; but for the situation it might have been the work of a robin. Lastly, this many-storied tenement house became the eyrie of a sparrowhawk, whose household furniture of straw and moss reached halfway up to the doorway. A strange tale of a hole, surely; but there was more yet to be learned from the old stub, and, allowing fullest weight to circumstantial evidence and accepting the supposititious as a fact, I may be allowed to relate as a matter of established history that on a certain day Sir *Faleo sparverius* brought home to his brood a tiny shrew, of the species yecept by scientists the *Sorex cooperi*. Now, it chanced that the young hopefuls of the robber baron were not just then very hungry—oh! marvelous chance—so that the *Sorex cooperi*, being left to his own devices, set about to escape, and so far succeeded that he burrowed down through the home effects of the Kestrel and the moss-builder, but when so far the hard mud floor barred further progress, and the poor little captive, weary and wounded, soon died in the buried nest; and there I found him, like Ginevra in the oaken chest, when long afterwards I broke open the rotten timber and made it disclose a tragic tale that, may be, never happened at all.

In this region (Carberry) the flicker seems to prey principally on ants, taking them sometimes from the rotten stumps that are honeycombed with their galleries, but more often, I believe, from the mound-like ant-hills which are to be seen on the prairie in such numbers. His method of attack seems to be by first pecking a hole in the center of the hill, and then as the ants come swarming out he dispatches them till his appetite is satisfied. Afterwards he comes again and again to the hill till it is completely depopulated.

On the 27th July, 1884, I saw one of these birds dusting on a sandy spot near the Assiniboine River. He performed the operation as skillfully as a quail and was evidently used to it.

In cold, stormy weather they roost on the ground amongst the long grass at the root of a stump or tree. On the 29th September I put several out of such places just at dark. They were very loth to leave, my dog almost jumping on them before they would get out. (Nash, in MSS.)

142. *Antrostomus vociferus*. Whip-poor-will.

Common summer resident in woods and bluffs. In numbers at Pembina (Coues). Pembina (Lay). Dufferin: Arrived May 8, 1874 (Dawson). Winnipeg: Summer resident; abundant (Hine). Its voice is known at Red River Settlement (Blakiston). Ossowa: Breeding (Wagner). Oak Point: 1884; first heard May 8; next heard May 12; heard again on 13; is common and breeds here (Small). Portage la Prairie: Common summer resident; arrives about May 20; departs early in September; found young partially fledged as late as July 29 (Nash). Abundant in the north; Manitoba House, June 17, 1881; Grand Valley (Macoun). Carberry: Common summer resident; breeding; Long River (Thompson). Two Rivers: 1885, first heard, one, May 21; next, May 24; fairly rare (Criddle). Brandon: May 25, 1887 (Wood). Shell River: 1885, first heard, one, May 20; common all summer; remains until August (Calcutt). Qu'Appelle: Occasional (Guernsey).

On May 17, 1882, at Long River Gorge, a partly wooded country, the best we have seen yet, heard a number of whip-poor-wills chanting their familiar strain towards night. This is the first notice of their arrival. June 6, went late in the evening to the eastern slough to observe the two nightjars. Both of these, as well as the mosquitoes, were in full force. But as the shades of night closed in the night-hawks that hitherto had been chiefly noticeable became less noisy, and their cousins, the whip-poor-wills, became the principal performers in the full concert. How many there were it would be hard to say, but certainly not less than a dozen appeared to be in the near neighborhood, and the chorus of voices loudly reiterating "whip-poor will" was always a full one of at least three voices. As I lay in the grass and listened to these various voices of the night I attempted a clumsy imitation of the notes "whip-poor-will," and was pleased to see one of these birds come flying around me closer and closer until at length it hovered but 18 inches from my face in the grass. For a moment or two he poised and inspected me; then flying away he returned immediately with another, his mate probably, and the pair skimmed about me once or twice; then the wing motion, which I could barely discern in the gloom, ceased in the vicinity of a certain stump close at hand. At once I concluded that the bird had alighted, and then the calmness of the night was shocked by the usual tragedy.

The refrain is almost too well known to need description. It consists of three, or sometimes four, notes, "whip-poor-will," or "ah-whip-poor-will." The "ah" is very faint at best; the "whip" and "poor" are rich and smooth, but with an accent on the former; the "will," uttered

with a rattle, great force, and emphasis, seems at half the distance from you and not quite the same direction as the first notes.

On June 27, 1883, in the dry open woods to the south, I found the nest of the whip-poor-will. The two young ones were covered with yellow down, which made them very conspicuous on the dark leaves. They were close to the base of a very large poplar and only 20 feet from an oven bird's nest. No attempt at nest building was observable.

The whip-poor-will (*Antrostomus vociferus*) differs from its near relative, the night-hawk, in several particulars. It seldom leaves the woods and comes out onto the open prairie; and even among the trees it is seldom or never seen sailing about high overhead during daylight. It is also a much shyer bird; and, although its highly remarkable far-sounding voice may often be heard, it needs great caution to get within a sufficiently short distance to see the performer. (Christy.)

143. *Chordeiles virginianus sennetti*. Night-hawk.

Very abundant summer resident. The type of this variety was taken by the describer, Dr. Coues, on the boundary 50 miles west of Pembina. I therefore assume this to be our only form. Pembina and westward along the boundary to the Rockies (Coues). Winnipeg: Summer resident; abundant (Hine). Ossowa: Breeding (Wagner). Oak Point: 1884, arrived May 25; 1885, first seen, one, on May 19; next seen on May 23; is common and breeds here (Small). Portage la Prairie: Abundant summer resident; arrives about May 20, departs about September 15; in 1884, first seen May 27 (Nash). Abundant in the Northwest; specimen shot at Manitoba House, June 16, 1881 (Macoun). Carberry: Abundant summer resident; breeding (Thompson). Dalton: First seen, one, on May 27 (Youmans). Two Rivers: 1885, first seen, several, May 23; next seen, May 25; became common on and after May 27; breeds here (Criddle). Shell River: 1885, first seen, one, on May 23; next seen, ten, on May 24; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives May 21 (Guernsey).

On August 1, 1883, while in the eastern sand hills with Miller Christy, we found the two young of a Night-hawk sitting on the bare ground in the open. They seemed about 3 days old. On the tips of their beaks were still the hard white points with which they are furnished to aid them in chipping the shell. The old shells were lying around the nest, as is the case with the *Preoces*, and but for these I should have passed by the young ones, as they had squatted close to the ground and shut their eyes, for the blackness and brilliancy of these would almost certainly have betrayed them. I gently touched one of them, whereupon it crouched down more closely to the ground; but its companion, rising up, hissed with open beak and snapped savagely at my fingers. On being further teased they ran off, exactly in the manner of young ducks, with outstretched wings and with neck and body at an angle of 45 degrees. After running a few feet they stopped, squatted as before,

and closed their eyes. This they repeated several times, but at best they only made little progress, and each time on being overtaken the bold one was always ready to fight. This proved to be a male; the sex of the other was not ascertained, but probably it was a female. At this age the middle claw is not pectinated.

In the light of these observations it seems likely that in some of the cases in which the Night-hawks are supposed to have carried off their young, the latter had really run from danger, or were led away by the parent birds. It is pretty well established that these will remove their eggs from a dangerous locality, carrying them in their mouth, but it is difficult to understand how they could so transport their young.

On May 29, 1884, watched a Night-hawk booming a number of times in broad daylight; each time, just as the boom began, the wings were brought forward, so that the two together formed a half moon, with the points downwards, and as well as I could discern, the tips of the wings vibrated out of sight while the sound continued.

The courting and mating ceremonies, apart from the booming, are carried out chiefly on the ground, where the male may be seen chasing his mate about and around the logs and bushes. When thus engaged they do not hop, but always run, as far as I have been able to observe.

As already intimated, the eggs, which, to the best of my knowledge, never exceed two in number, are laid on the bare ground; they are peculiar in being of the same shape at each end, both in fact being big ends. When sitting on them the old bird will close her lustrous black eyes and remain perfectly still until nearly trodden on; then, finding herself discovered, she will flutter off and attempt, by the usual shamming of lameness, to lead the intruder away from her treasure. According to Audubon, these birds will remove their eggs when much molested. My own experience shows that they will desert the eggs, but I have never known them to be removed by the birds themselves.

The old theory of the Night-hawk's booming was that the sound was caused by the air rushing past the wide, gaping throat; but the present idea seems to be that it is made by the wings. In support of the latter I would adduce the following reasons: First, the sound bears evident resemblance to the drumming of the partridge and of the snipe; second, it may be *accurately* imitated by throwing a large nail sideways through the air; and last, the following observation on the crow, a not very wide-mouthed bird, points, I think, to a wrong origin for the sound.

Toronto, May 14, 1885: While watching a crow being chased by another, I noticed the foremost one dive suddenly downwards and then up again; the pursuing bird followed even more quickly, and as it swooped upwards it produced at the turn a *boom* similar to that of the Night-hawk, but duller and in a lower key, as might have been expected from the larger feathers and slower flight of the crow.

The Night-hawk subsists chiefly on insects, which it devours on the wing; but Wilson examined some whose gizzards were full of crickets, a prey that must have been taken from the ground. On several occasions I have found the stomach full of grasshoppers, and in one I found a number of pebbles. As soon as the young are strong on the wing the species is seen in flocks and begins to depart, for it is one of the earliest to move of the fall migrants. These flocks are very long and straggling, though few in numbers; the largest I ever noted contained forty-one of the birds. (Carberry.)

The eggs of the Night-hawk (*Chordeiles virginianus*) were several times found on the bare ground among the sand hills [on the north side of the Souris, near Plum Creek], with no approach to a nest for the helpless young. The parent birds endeavored to draw us away from their eggs, fluttered as if wounded a short distance from them, and uttering cries of distress. (Hind, July 1, 1858.)

Among the trees on the sand hills and in the bluffs the Night-hawk (*Chordeiles popetue*) is abundant and makes itself very conspicuous towards evening by its loud scream, by booming, and by displaying during flight the unmistakable white patch on each wing. Not unfrequently it may be seen on the wing at midday; and it always makes an appearance long before sunset, sailing about at a great height and screaming frequently. After flying a while over the head of any intruder it suddenly spreads its wings, and, giving a wide swoop downwards, emits a loud booming noise, which has gained for it in some parts of America the name of "Bull Bat." That this noise is made over one's head in order to threaten or intimidate seems to me pretty certain; but I have also, I believe, heard it emitted at a distance, without any such object.

The number of old birds began to get very much less by the end of August, but a few were nevertheless seen until well on into September—one as late as the 11th. After the migration commenced they were not unfrequently seen in the evenings flying over in large straggling parties, circling about as they proceeded. These parties usually traveled southwest, I believe, though this is not the direction usually chosen by the other birds of the district when moving south. (Christy.)

Early in June, 1882, I witnessed the courtship of a pair of these birds. It was a very pretty sight. The spot selected for their meeting was a small bare patch of ground in the edge of the scrub, evidently where an old camp fire had been made. About this the male strutted, posturing most gracefully before his mistress, reminding one somewhat of the antics of a male tame pigeon when similarly engaged. (Nash, in MSS.)

144. *Chætura pelagica*. Chimney Swift.

Tolerably common summer resident. Common at Pembina, and thence westward to Mouse River (Coues). Pembina (Lay). Winnipeg: Summer resident; abundant (Hine). Portage la Prairie: Common summer resident; arrives about May 16, departs early in September; in 1884 first seen, May 17 (Nash). A few observed at Swan Lake House, July 8, 1881 (Macoun). Carberry: Rare and not breeding (Thompson). Brandon: April 21, 1887 (Wood).

A nest examined by me at Winnipeg, July 15, 1883, contained four eggs. The young were hatched a few days after. From that time the young remained in and around their nest until September 4, when they flew for the first time, and at once disappeared. After the young grew too large for the nest they arranged themselves in a row, touching one another, but slightly below each other, and clung to the wall. In that position they remained until they took their final departure. (Nash, in MSS.)

145. *Trochilus colubris*. Ruby-throated Humming Bird.

Tolerably common summer resident of sheltered gardens. Quite common at Pembina; not seen west of this point (Coues). Dufferin: Arrived May 17, 1874 (Dawson). Known about the gardens of Red River Settlement (Blakiston). Winnipeg: Summer resident; tolerably common as far north as Big Island Lake, Manitoba (Hine). Oak Point: 1884; arrived May 25 (Small). Portage la Prairie: Common summer resident; arrives about June 3; also near Winnipeg (Nash). Specimens seen on Red Deer River, at the head of Lake Winnipegosis, August 16, 1881 (Macoun). Not observed on the Big Plain (Thompson). August 29, south slope of Riding Mountain, humming birds were observed; Bad Woods; "First humming bird was noticed here" (Hind, 1858). Shell River: 1885; first seen June 3 (Calcutt). Qu'Appelle: Occasional; not plentiful (Guernsey). Norquay: 1884 (Christy).

146. *Milvulus forficatus*. Scissor-tailed Flycatcher.

Accidental visitant. Winnipeg: Accidental (Hine). Portage la Prairie: One found by Mr. C. W. Nash, 2d October, 1884.

The Swallow-tailed Flycatcher (*Milvulus forficatus*) is such a characteristically southern bird that its accidental occurrence in Manitoba is worthy of note. Last January I was shown a splendid specimen taken at Portage la Prairie by Mr. Nash. He found it lying dead on the prairie on the 20th October of 1884. Its stomach was empty, and the bird was very emaciated, although in fine plumage. On the previous night there was a sharp frost. In addition to this record, I quote the following rather startling statement from the Report on the Hudson Bay, by Professor Bell, of the Canadian Geological Survey, 1882:

But the most singular discovery in regard to geographical distribution is the finding of the Scissors-tail, or Swallow-tail, Flycatcher (*Milvulus forficatus* Sw.) at York Factory. * * * The specimen in the Government Museum was shot at York Factory in the summer of 1880, and I have learned since that these remarkable birds were occasionally seen at the posts of the Hudson's Bay Company, all the way west to the valley of the Mackenzie River.—E. E. T.

147. *Tyrannus tyrannus*. Kingbird.

Very abundant summer resident wherever there are any trees; extremely numerous at Pembina; breeding; abundant along the line westward to the Rockies (Coues). Winnipeg: Summer resident; abundant (Hine). Big Ridge: Most common of all was the tyrant flycatcher (*Muscicapa tyrannus*) which endeavored to hold undisputed sway over the bluff he had selected as his home (Hind). Ossowa: Breeding (Wagner). Oak Point: 1884, arrived June 3; 1885, first seen, one, on May 21; next seen, one, on May 22; is common and breeds here (Small). Portage la Prairie: Very common; summer resident; arrives about May 17; departs the first week in September; in 1884, first seen, May 17 (Nash). Very common throughout the Winnipegosis region examined in 1881;

chiefly on borders of prairies or openings (Macoun). Carberry: Abundant summer resident; breeding; Duck Mountain (Thompson). Two Rivers: 1885, first seen, one, on May 21; next seen, May 23, when it became common; is common here (Criddle). Dalton: 1889, first seen, one, on May 24; next seen on May 25; breeds here (Youmans). Shell River: 1885, first seen, one, on May 21; next seen, five, on May 24; is common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives May 24 (Guernsey).

On June 21, 1882, down by the slough in a low bush, found a Kingbird's nest. It was just completed and contained no eggs yet. The king and his wife made more fuss over my intrusion than most birds would have done had the nest been full of young ones.

Further on I found another nest of this species. It was placed on the top of a stub, about 8 feet high. The bird flew off. The nest was made of roots and fine fibers, and contained four eggs. One of them measured $1\frac{1}{8}$ by $\frac{5}{8}$; it was creamy white, with a few clear spots of brown and lavender, inclined to form a wreath about the large end; the others were similar; all were quite fresh.

On August 20, 1883, shot a young Kingbird; male; $6.8\frac{1}{2}$; extent, 14; stomach full of insects; no crown patch of bright color. The species may now be seen far out on the open prairie, a mile or two from timber, catching insects on the wing or on the ground, availing itself of the tallest weeds as perches, or failing these it settles on the prairie. I believe it never runs when on the ground, but takes wing each time it changes its location. It is common to see the species in small parties of four or five; these are doubtless the family of the season. They continue together under the guidance of the old ones till they migrate. This took place last year about the first week in September.

On June 17, 1884, at Duck Mountains, heard the blackbirds screaming in the distance, while above their noise was heard the shrill twitter of the Kingbird. These grackles had ventured too near the king's home and he was showing them their mistake.

July 24, while climbing to a hawk's nest, the old birds came flying about my head uttering their piercing whistles; these attracted the attention and roused the indignation of a Kingbird, who immediately gave chase and soon had the satisfaction of knowing that he was making himself consummately obnoxious to the hawks, for they could not keep him off and they would not fly away, so that he worked his tyrannical little will on them much as he pleased. As well as I could make out he took several rides of over a hundred yards on one of the hawks, and no doubt when perched on its back he was not idle.

It has been questioned whether the Kingbird really exerts physical violence with beak, etc., in the aerial combats for which it is noted, the counter proposition being that the predaceous birds have a dislike of a scene and know that an uproar is fatal to their designs, and therefore they beat a retreat as soon as their vituperative little adversary appears.

I am inclined to think that while there is much truth in the latter view the former is not wrong, as the above goes to show, and the aerial activity of the flycatcher saves him from any attempt the hawks may make to summarily end the persecution.

The Kingbird has a peculiar method of expressing his devotion to his mate. On the warm spring evenings he may be seen leaving his post by her side, in some low tree, and launching out he rises to a height of 30 or 40 feet in the air and gives vent to a tremendous sustained volley of screams and twitters, during which he continues to dart backward and forward in a frantic sort of a way, making a very demonstrative but harmless charge at any passing bird, and illustrating several fanciful methods of flight until, having relieved his feelings and covered himself with glory, he swoops down into the bush to receive the applause of the only spectator he seeks to please. The food of this bird consists chiefly of coleopterous insects, but I have occasionally found seeds in its gizzard. In the pursuit of its ordinary prey it may often be seen far out in the prairie, miles from any trees. Under these circumstances it avails itself of the tall weeds as perches, or, failing these, settles on the ground. The young continue with the parents until all move southward.

The well known Kingbird or Tyrant Fly-catcher (*Tyrannus carolinensis*) is abundant in Manitoba. A more fearless, inquisitive, pugnacious, and warlike bird it is difficult to imagine. Often when I have shot a bird as a specimen, up has flown a Kingbird with a manner which gave him the appearance of saying, "Now, what's going on here?" To see a Kingbird dash at and attack a huge harrier, for no other purpose whatsoever than to have a fight, is a thing of common occurrence, and the harrier always tries to avoid and escape from his assailant. The Kingbird breeds in the low scrubby oak trees which cover the sand hills, building, like the shrike, a nest consisting largely of the stalks of a species of *Gnaphalium*. After the young are able to fly they often live round the settlers' houses on the open prairie, but about the end of August they all leave. (Christy.)

During August I frequently saw these birds drop onto the surface of the water of the Red River and remain there floating down with the current for some minutes at a time. Occasionally they would, whilst there, work their wings as other birds do when bathing, and so wash themselves. (Nash, in MSS.)

148. Myiarchus crinitus. Crested Flycatcher.

Very rare; summer resident of thick woods. Winnipeg: Summer resident; tolerably common; a few taken (Hine). Lake Manitoba: June 17, 1881 (Macoun). I frequently heard the sonorous croak of this bird in the Carberry spruce bush, but never satisfactorily established its presence there until the summer of 1886, when my brother, Dr. Arthur S. Thompson, sent me a male specimen, killed there on June 6 (Thompson). Portage la Prairie: Rare summer resident; one pair bred in the woods near the Assiniboine River each year (Nash).

149. *Sayornis phœbe*. Phœbe. Pewee.

Rare summer resident; one or two pairs seen each season; usually nests under bridges. Winnipeg: Summer resident (Hine). Oak Point: 1884, arrived May 15; scarce; 1885, first seen, two, on May 22; next seen, one, on May 24; is common and breeds here (Small). Qu'Appelle: Tolerably common; summer resident; arrives May 20 (Guernsey). Portage la Prairie: On the 11th of May, 1885, I believe I heard one of these birds calling on the south side of the Assiniboine River, but as I was on the north side and the river was bank full I could not cross to make sure of him (Nash).

150. *Contopus borealis*. Olive-sided Flycatcher.

Common; summer resident of woodlands. Winnipeg: Summer resident; tolerably common (Hine). Rare; three specimens seen on Red Deer River and Pembina Mountains; also Waterhen River; evidently breeding (Macoun). Carberry: Tolerably common; summer resident; Duck Mountain, common; Portage la Prairie, occurs (Thompson).

On July 26, 1883, in the tamarac swamp beyond the spruce bush I noticed a very noisy flycatcher; its note was loud, and its habits were much like those of the Great Crested Flycatcher. After some trouble, for it was very shy and kept chiefly among the topmost branches of certain dead trees, I succeeded in getting it. It proved to be a male Olive-sided Flycatcher; length, 7; stomach full of flies.

June 12, 1884, Duck Mountain: A high wind has silenced most of the birds. Shot an Olive sided Flycatcher, a male, stomach full of beetles and flies; it was uttering a robin-like "*chuck-chuck*." The habits of this species seem to be somewhat between those of the Great Crested Flycatcher and the Wood Pewee. It is quite common here.

151. *Contopus virens*. Wood Pewee.

Tolerably common; summer resident of woods; Pembina (Coues). Winnipeg: Summer resident; tolerably common (Hine). Portage la Prairie: Common summer resident (Nash). Waterhen River (Macoun). Carberry: Rare; Duck Mountain, very common (Thompson). A specimen from northern Minnesota in collection of Smithsonian Institution (Blakiston).

On June 14, 1884, at Duck Mountain, in the spruce woods, I shot a Wood Pewee. It was uttering its familiar drawling note, *p-e-e r-e-e*, in its usual sleepy fashion. It is one of the very common birds of the thick woods of this region. Its cousin, the Western Wood Pewee, is equally common in the more open woods and groves. I was unable to keep specimens.

152. *Contopus richardsonii*. Western Wood Pewee. Richardson's Pewee.

Tolerably common; summer resident of woods and bluffs. Winnipeg: Summer resident; tolerably common (Hine). Carberry: Rare; west

slope of Duck Mountain, common (Thompson). Cumberland House: June, 1827 (Richardson).

On June 12, 1884, at Duck Mountain, I shot a Richardson's Pewee. The species seems quite common. In manners, habits, and note, it is a much sprightlier bird than its cousin *virens*. Instead of the drawling *p-e-e r-e-e* of the eastern bird, the usual note of this one is a loud, emphatic "*right-here*," which sounds peculiarly appropriate, when, gun in hand, one is cautiously and laboriously following the playful bird through the dense willows it frequents, and inwardly and intensely asking oneself: Where in the name of goodness has he got to now?

This species commonly frequents the open woods and willow thickets, while the *virens* seems to keep to the higher, heavier timber.

153. *Empidonax flaviventris*. Yellow-bellied Flycatcher.

Summer resident in woodlands. Duck Mountain, June 11, 1884, shot a flycatcher that was uttering continually a note like "*che-blic*;" it was all over of a greenish color, but yellow on the belly; it answers fairly well to the description of *flaviventris*, but is very like an Acadian shot yesterday; evidently the species is breeding here (Thompson).

154. *Empidonax acadicus*. Acadian Flycatcher.

Summer resident in woodlands. Breeding commonly at Manitoba House, June 15, 1881; nest taken somewhat like a *Vireo's* (Macoun). Binscarth: Duck Mountain; common (Thompson).

June 10, 1884, Duck Mountain: Collected Acadian Flycatcher to-day; it seems quite common here. June 12, Duck Mountain: Collected another Acadian Flycatcher; the species is quite common here.

155. *Empidonax pusillus traillii*. Traill's Flycatcher.

Summer resident, and doubtless much more widely diffused and common than these fragmentary observations would seem to indicate; common at Pembina during the migration in the first week of June (Coues). Lake Manitoba: June 17, 1881; only one specimen procured (Macoun).

156. *Empidonax minimus*. Least Flycatcher.

Very abundant summer resident of open groves; very abundant at Pembina; found also in Turtle Mountain; breeding (Coues). Lake Manitoba: nesting (McTavish). Shoal Lake: May 15 and 23, 1887 (Christy). Oak Point: 1884, arrived May 11; 1885, first seen, one, on May 22; is common, and breeds here (Small). Portage la Prairie: Common summer resident; arrives about May 16 (Nash). Found at Lake Manitoba and Red Deer River; also very common in the woods at Manitoba House; June 14, 1881 (Macoun). Carberry: Abundant summer resident; Turtle Mountain (Thompson).

On May 22, 1882, at land office, Turtle Mountain, saw Least Fly-

catcher in scrub along the river. It was flitting among the brushwood and the branches of the new-leaving poplar trees, uttering a note which I found I could as well—or as ill—express by the totally different syllables “*p-chr*,” “*p-chr*,” or “*sé-wick*,” or “*s split*,” “*s-split*,” or “*chebec*,” “*chibec*,” or “*s-lick*!” Each of these is supposed to represent the same note, and each comes as near it as such descriptions can. This flycatcher was extremely busy perforce to keep himself alive in this inclement weather, when insects, his only fare, are so scarce.

By June 20, the Least Flycatcher is very common in the trees along the slough side woods and on the edges of every grove. Its constant occupation while perching is to reiterate its peculiar note “*chebec*.” What the “naturally selective” object achieved by this may be, I can not say, unless it has the effect of notifying the various birds of this species of each other’s presence, and thereby facilitating and expediting the duties of finding and choosing a mate.

On June 8, 1883, shot a pair of Least Flycatchers. One measures: Length, $5\frac{1}{2}$; extent, $8\frac{1}{4}$; it answers to Jordan’s description, but the lower mandible is yellowish. The other is similar; it is to be seen darting about after insects in every thicket and grove; its usual habit is to sit on a prominent lookout twig, pumping its tail, and “*chebec*”-ing until some hapless insect passes near, when he ceases his too monotonous tricks, launches forth, seizes his prey with an audible snap of his mandibles, and dashes again to his perch to take up the “*chebec*”-ing where he left off. This is a very abundant species here, on the plain. It is also a very lively bird, and has several different notes; one of these almost approaches a song.

May 30, 1884: Who ever would credit the chebec, a flycatcher, a clamatore, with singing a song—yet to-day I saw one that, in the exuberance of his spring exhilaration, soared up in the air and hovered in true flycatcher style to vociferate for over half a minute a song like “*chebec-tooral-ooral, chebec-tooral-ooral*,” etc., and having finished gave a loud snap with his bill—a smack of delight—and glanced downwards aslant into a bush.

157. *Otocoris alpestris praticola*. Prairie Horned Lark, or Prairie Shore Lark.

Abundant resident of the prairies except in winter. Breeding specimens from Carberry and Pembina are identified by Mr. Dwight as *praticola*, also fall specimen from Rat Portage; from Red River westward, along the boundary to the Rockies, it breeds in profusion (Coues).* Shore Lark arrived before April 15 (Dawson). Winnipeg: Summer resident; abundant (Hine). Oak Point: 1885, first seen, four, on March 28; next seen on 29th; is common, and breeds here (Small). Portage la Prairie: 1884; common spring and fall visitant; stays nearly all the winter; disappears and reappears at intervals; arrives about March 20; reappears in August, and departs in October (Nash). Very abundant

* Specimens from the plains proper are *O. a. arenicola*.—R. R.

on prairies; trails along our route from Livingston to Fort Pilly and down on the west side of the river, in company with Lap Longspurs, first half of September (Macoun). Carberry: Abundant summer resident; breeding nine each season; resident, except during December, January, and February (Thompson). Two Rivers: 1884; arrived March 23 (Criddle). Brandon: 1882, March 20 (Wood). Shell River: 1885, first seen, fifty, on May 23; common in flocks going north; a transient visitant; not breeding (Calcutt). Qu'Appelle: Common summer resident; arrives April 1 to 25 (Guernsey).

On May 12, 1882, at camp 8 miles south of Brandon, midway between our tent and the fire 10 feet away, I started a small bird from its nest. It ran away very reluctantly, and continued wistfully close at hand, running about among the tufts of grass in the glare of the fire, and returning each time as soon as it dared. At gray dawn I found her on the nest again; she slowly walked away when I approached to rekindle the fire, but returned almost immediately with her mate; and now, for the first time, I saw them plainly. They were a pair of Shore Larks. Encouraged, no doubt, by the presence of her mate, she once more crept up to her nest and took up her position on the eggs, although I was but 5 feet off. Frying our bacon over a brisk fire, I was very careful to avoid hurting the birds or their home; and breakfast being over, travelers, tent, fire, and horses all went off and left them to discharge their duties in peace. The nest contained three brown eggs; it was sunken in the ground, and was made of grass and fiber, and lined with two or three large feathers.

My first real acquaintance with the Shore Lark at his home was in Minnesota, in the last week of March, 1882. A fearful blizzard, of course "the worst ever known in the country," had been raging for two days or more. On the third day, when it was nearly over, I was making my way out to see to the cattle. All the fences and low buildings were buried in snow, but the tall form of an elevator loomed up out of a circle of bare ground, caused by the eddying of the blast, and here, in the very vortex of the storm, in the thickest of the fight, were three or four little Shore Larks, bracing themselves against the driving wind and picking up the seeds that had been exposed by the displacement of the snow. Poor little things! I thought, you must be nearly at death's door; but even while I looked one of them, under the lee of the building, perched himself on a frozen clod and poured out his sweet, simple little song in a way that seemed to say, "How happy am I."

But the longest night will end, and it is not always winter, even at the Pole. The spring comes, and "the time of the singing of birds" arrives, and the brown Shore Lark raises his horns with sprightly air, and those who may chance to see him are now reminded that he is a near kinsman to the famed skylark—that indeed he is a skylark. Thus far he has sung only while perching on some clod or stone, but now

the ardor of his devotion to the demure little quakeress by his side demands a more ambitious demonstration; so, ceasing to sing, he strenuously endeavors to associate with the white piling cumuli, and having soared, apparently, near enough to be uncomfortably damp, while to us he appears a mere speck, he floats on vibrating wings, singing a song composed of a single note, oft repeated with lessening intervals; it may be suggested by the syllables *trick, trick, trick, trick, trick, trick, t-r-r-r-r-r-r-r-r-r,*" the notes at last all running together like the drumming of a partridge. During this performance he has lost much of his altitude, but at once proceeds to regain it by a series of bounds before again repeating the song. This alternate soaring and singing is usually kept up for over ten minutes, then the musician, having exhausted his energy, suddenly stops and dashes down with one frightful headlong pitch, right into the grass. Upon going to the spot one is surprised to find he has not been dashed to atoms by the violence of the fall, but springs up, uttering his usual call note, and flits further off, again to settle on the ground.

The whole of this performance will be seen to resemble very closely the serenade of the Missouri Skylark, the chief difference being that the Shore Lark is inferior in music and staying powers, and also in that the latter remains more nearly over one particular place. Another point of dissimilarity is, the Shore Lark sings chiefly on the ground, while the skylark confines his effusions almost entirely to his moments of physical elevation.

The Shore Lark is the earliest of the prairie singers to begin in the morning, being even a little earlier than the Meadow Lark; it commences before there is any sign of dawn, and at night it continues until the plains are enveloped in perfect gloom.

But singing will not multiply the species, and the two little "Quakers," as they are often called, set about nesting ere yet the snow is gone. Not seeking the shelter of bush or bank, but right out on the open prairie, on the level, they scrape a hole about an inch deep, then line it with grass and perhaps a feather or two from their mortal enemy, the hawk. In this are laid four or five brown eggs, freckled all over. This species has a curious habit, in common with the Baywing Bunting, of running on the road just before one and flying a little further on when overtaken. The Shore Lark does not usually repeat the maneuver more than twice or thrice, and frequently it suddenly squats and remains so until nearly within reach, when it springs up uttering its triple call-note and flies away to one side.

My observations incline me to believe that in Manitoba the species raises two broods each season.

157a. *Otocoris alpestris*. Shore Lark.

Fall migrant. Specimens of the true *alpestris* were taken by myself at Rat Portage and at Carberry in the fall (Thompson). Severn House: It appears common (Murray).

158. *Pica pica hudsonica*. American Magpie.

Rare, and found chiefly in the west. Rare; resident in the woods about Lake Winnipeg; have a single specimen taken 30 miles east of Brandon (Hine). One at York Fort (Hutchins). I have noticed these in western Manitoba only (Hunter). I was informed that this bird was not uncommon in the woods near the Assiniboine River, 20 or 30 miles west of Portage la Prairie, about fifteen years ago; but since that they have entirely disappeared (Nash). Have been told of its occurrence at Fort Ellice in the winter of 1881; did not see it; Upper Assiniboine, September 27, 1881 (Macoun). At Fourth Lake, Qu'Appelle: "Magpies are very numerous in the thin woods fringing the lakes," 1858 (Hind). Qu'Appelle: Occasional; plentiful 100 miles north (Guernsey). Only stray individuals passing to the eastward of the Mississippi or of Lake Winnipeg. * * * It does not entirely quit the banks of the Saskatchewan, even in winter (Richardson). Magpie first seen on the 7th of October at Mosquito Point, where the Belted Kingfisher was last seen; observed occasionally at Carlton, where it resides in the winter; not seen between Hudson's Bay and Lake Winnipeg (Blakiston).

She pe cum memewuck: the Magpye of Pennant. This bird breeds in trees; are plenty in the interior parts of the country, and a few are found near the southern settlements. In my twenty years residence in Hudson's Bay, I never knew them migrate to York Fort or Severn; only one was caught in a marten trap at York Fort. I don't think they migrate any distance, as our people met them inland at all seasons. (Hutchins's MSS., Observations on Hudson's Bay, 1782.)

159. *Cyanocitta cristata*. Blue Jay.

Tolerably common summer resident in woodlands; very abundant at Pembina (Cones). Pennawa River, September, 1857 (Hind). Breeding near Lake Winnepeg (D. Gunn). Swampy Island: 1885, common, resides permanently; they go to the south end of the island in summer to breed (Plunkett). Winnipeg: Summer resident; tolerably common (Hine). Oak Point: Arrived May 29, 1885; first seen, a flock of eight that flew overhead on May 24; next seen, three on May 25; a letter to Professor Cooke mentions that (February 6, 1885) two remained all winter about the place, and became quite tame (Small). Ossowa: Common; breeding; 1885, last seen, one on October 19 (Wagner). Portage la Prairie: Common; resident; the majority leave this locality in the winter, but I have seen some in every month in the year (Nash). Carberry: Tolerably common summer residents; breeding. Rat Portage: October (Thompson). Arrives early in April, departs late in November (W. G. A. Brodie). Found at Red Deer and Swan Rivers, September 2, 1881 (Macoun). Shell River: 1885, first seen, two, on May 15; next seen, three, on May 24, going north; a transient visitant; not breeding here (Calcutt). Qu'Appelle: Tolerably common summer resident; arrives May 6 (Guernsey). A specimen

from Red River Settlement in Smithsonian Institution; I noticed the absence of it on the route between York Factory and Lake Winnipeg (Blakiston).

160. *Perisoreus canadensis*. Canada Jay. Whisky Jack. Wis-Ka-tjan.

Common resident in wooded sections, especially among evergreens. Winnipeg: Summer resident; tolerably common (Hine). Red River Valley: Common resident; they breed here (Manitoba) in the month of March (Hunter). Resident locally at Portage la Prairie; very scarce (Nash). Very abundant in all the wooded country examined in 1881 (Macoun). "Whisky Jack numerous on the Scrub Oak Ridge," near Dauphin Lake, October 9 (Hind, 1858). Carberry: Common resident; breeds in the spruce woods to the south; Duck Mountain; Two Creeks, on Upper Assiniboine; Rat Portage, abundant (Thompson). Shell River: 1885; winter visitant (Calcutt). Severn House (Murray). Common at Carleton (Blakiston).

On October 13, 1883, at Two Creeks, west side of Assiniboine, I was awakened in the morning by a Whisky-Jack screaming close to my head. One or two of these birds have been in attendance at each of our camps since we came to this comparatively wooded region, to feast on the camp scraps, which we have always been careful to put where the birds could easily get them.

On June 11, 1884, at Duck Mountain, I found the young Whisky-Johns following their parents through the woods. One of these, which I shot, was all over of a very dark bluish gray, tinged on the wings and tail with a glaucous shade, which at once reminded me of the relationship existing between this bird and the Blue Jay. The noises which this family made were curious and varied. I have long ago learnt to ascribe to this species any unknown squeaks or wails that are heard in a spruce wood.

November 8: Whisky-Johns came as usual to our camp fire to day. They helped themselves to scraps but a few feet from me, and ultimately one alighted on the pot stick and took off a scrap of meat that I left there, although it was but a foot above a hot clear fire.

While moose hunting on December 6 we had crawled close to a herd, when suddenly the loud screaming of the Whisky-Jack was heard, and before we could get a glimpse of them the moose had sought safety in flight.

During the numberless times that I have camped in the winter woods of the northwest, I have hardly ever failed to have the Wiskachon for a companion. Sometimes I have been awakened in the morning by the melancholy wailing of the bird a few inches from my head. Many a time I have fed it with scraps placed in such situations that its courage would be sorely tried before it could secure the dainties. Once I laid a piece of meat on the snow between myself and my companion. After one or two approaches the bird rushed in and seized the morsel. Then I laid

a piece between myself and the fire some 6 feet away; this also was taken. Finally I stuck a piece on the end of the pot stick, which is a stout stick propped up so that it affords support to a kettle over the fire; and although by so doing the bird had to fly down within 6 inches of a hot clear fire, without hesitation it dashed in and secured the prize. Long experience has taught it that a camp is a sure place for a feast, and as soon as the ax is brought into play to prepare the fire-wood it is usual to hear the responsive "*tay tay*" of the Wiskachon approaching from some distant part of the timber. This call note of the species is much like the ordinary cry of the Blue Jay, but it has several others that are distinctively its own; this includes the melancholy sobs and wails which, sounding so uncanny among the gloomy evergreens, have surrounded the bird with an atmosphere of mythic interest. According to Archbishop Taché, Wesakedjan is the name of the coot and of the fabulous being who takes part in all Indian legends. Almost the only musical sound that I have heard it utter is a metallic "*chuck chuck*," not unlike that produced by the robin. The unmusical notes are so numerous that one is almost safe to attribute to the Wiskachon any unaccountable screams that may be heard within the presence of a spruce woods.

In the winter of 1881-'82 I saw one of these birds at Burnside, about 12 miles from Portage la Prairie, the only one I ever observed near there. In December, 1884, I found them abundant in the Riding Mountains, where they exhibited all the familiarity usually attributed to them.

In October, 1886, two or three frequented the woods on the bank of the Red River, but those were all I ever saw in that neighborhood.

Nearly all writers refer to the harsh notes of this bird, but omit to mention that it has some remarkably pleasing ones also, much resembling those of the Black Cap Tit but rather louder than it utters when traveling about in small parties, and also when alone if it feels particularly pleased with itself.

I can quite understand why trappers should dislike this bird, as it often does a lot of mischief to the skin of any animal that it may find dead in a snare, by eating holes in it; but it is a great favorite of mine, and will always be welcome to my camp, in spite of his petty pilfering of eatables. (Nash, in MSS.)

161. *Corvus corax principalis*. Northern Raven.

Tolerably common winter visitant; probably nesting in the northern lands. Tolerably common winter resident along the boundary (Coues). Winnipeg: Winter visitant; tolerably common (Hine). At Lake Winnipeg (Kennicott). Red River Valley: Resident, tolerably common more seen in winter than in summer (Hunter). "And in the spruce swamps were several ravens," October 9; near Scrub Oak Ridge, Dauphin Lake, Plains of the Souris, July (Hind, 1858). Portage la Prairie: Very scarce; permanent resident; in February, 1882, I saw one about 4 miles west of the city of Winnipeg, and on December 17, 1884, I saw two in the Reding Mountains (Nash). Carberry: Noted only in winter; Rat Portage, common in fall (Thompson). Not observed in the Winnipegosis region; but frequent in the Western Plains (Macoun). Qu'Appelle: Occasional (Guernsey).

December, 1882: During the past month or more I have seen a raven flying over the plain. From the tracks in the snow I learned that it was one of these that robbed my wolf trap of the bait. When flying overhead it resembles a large crow, but may be distinguished by its frequent sailing and by its voice; which is much deeper and is not unlike the bark of a dog, and it is from this I suppose that the bird is called "Barking Crow" by the Hudson Bay Company's employés. In the vicinity of Winnipeg it is a regular winter visitant, but when the spring returns it retires, probably to the rocky and timbered land in the region of the large lakes.

January 13, 1887, Rat Portage: Ravens continue as numerous as ever about the town. When unarmed one may sometimes approach within 20 feet of them. I subsequently saw the species in numbers at Schreiber's, north shore of Lake Superior (January 16), and at North Bay, Lake Nepissing (January 18), as well as at intervening points on the railroad. I observed it carrying food in its claws; and on one occasion, at North Bay, saw one transfer a bone from its beak to its claws and back again several times during flight. At Schreiber's they were particularly numerous and tame. Almost any strange, weird sounds, musical or harsh, heard in the woods there might, I found, be safely referred to the raven.

Raven (*Corvus corax*): Always to be seen; and so far from being a solitary bird, as it is called in Europe, I made a discovery in its habits of which I had no idea before. At the beginning of winter I observed that the ravens, which I saw about sunset no matter where I was, were always flying towards the same point, and I concluded there must be some large trees somewhere in that direction where a few pairs, perhaps, roosted. One day, therefore, after having been out with my gun, I made a point of returning to the fort in the evening by that quarter. Judge my surprise when, among some clumps of young aspen trees, none of which was above 25 feet high or thicker than my arm, I found one of these clumps literally filled with ravens, which, on my near approach, took wing and commenced flying about in all directions. I judged by counting a portion that there were upwards of fifty in that one place; and that no one should hereafter say, "Oh, they were a lot of crows," I shot one, which I keep as a specimen. I have been to the same spot on other occasions during the winter and always found my black friends. It is wonderful with what regularity of time they repair to their roosting place in the evening and leave again in the morning, by pairs, for their day's hunt. One pair flies directly over the fort each morning, and as I sit on watch for the minute hand of the chronometer to come round to each hour of observation as magnetic observer; they give a croak as they fly over, as a morning salutation, I suppose; at any rate I give them the credit for such civility; and looking to see the time I find it the same within two or three minutes, but gradually earlier and earlier, for the sun, which is their clock, is each day lengthening his course above our horizon. The raven is only known by the name "crow" here. (Capt. T. Blakiston, from Fort Carleton, 1858.)

162. *Corvus americanus*. American Crow.

Common summer resident of woodlands. A good many along Mouse River, at the boundary (Cones). Dufferin: Arrived before April 15 (Dawson). Red River Settlement: In 1859, before 4th of April; speci-

men from Nelson River in Smithsonian Institution (Blakiston). Winnipeg: Summer resident; abundant (Hine). Swampy Island: 1885, first seen, two, on April 6; next seen April 7, when it became common; is common all summer, and breeds here; last seen September 29; 1886, first seen, two, on April 6; bulk arrived April 8 (Plunkett). Cross Lake and at Lake Winnipeg (Kennicott). On Lake Winnipeg the young were able to fly in the beginning of July; not often seen in the woods; common on Hudson's Bay (Bell). Ossowa: Common; breeding; 1885, first seen, one, on March 29; next seen, April 10; became common April 16; last seen, one, on December 12 (Wagner). 1884, arrived end of March; 1885, first seen, one, on March 28; next seen on 29th; became common on April 10; is common and breeds here (Small). Portage la Prairie: Common summer resident; arrive at the end of March; depart about the middle of October; in 1884, first seen April 4; usually these birds come before the snow goes, but were late this year (Nash). Carberry: Abundant in migration only; summer resident; breeding at Fairview and at Binscarth (Thompson). Brandon: Two on April 10, 1887 (Wood). Dalton; 1889, first seen, three or four, on March 27; next seen on March 28; became common on April 8; breeds here (Youmans). Common on the Western Plains (Macoun). Shell River: First seen, five, on April 3; seen every day afterwards; common summer resident; breeds here (Calcutt). Two Rivers: 1885, first seen, two, on April 2; next seen, April 3, when it became common; ninety-one seen in one flight; fairly common and breeds here (Criddle). Qu'Appelle: Common; breeds April 1 to 5 (Guernsey). Trout Lake Station (Murray). Common all winter at Carleton (Blakiston).

On June 27, 1882, at Fairview, found a crow's nest in a poplar tree. It contained four fully fledged young ones. The old birds were very much excited. They flew about, cawing loudly. One of them alighted several times on a branch but 6 feet above my head, and, while cawing, or rather croaking, vigorously seized a twig in her bill and worried at it in a most savage manner, as though to indicate the treatment she would be glad to have me receive. Her voice during this curious performance was almost like a growl. Having noted that the nest was a remarkably strong, warm structure, and that the eyes of the young crows were blue-gray, I left the family in peace once more.

On August 30, 1883, on the road, I saw a flock of about two hundred crows; they appeared to be migrating. They were remarkably tame and let me approach them within 10 feet; of course I had no gun. With the flock were two brown harriers; once or twice I saw one of them make a sort of a stoop at a crow, but the latter took but little notice beyond moving a little further off. Later in the day I saw another flock of about thirty crows, and with them one brown harrier, who quite behaved as though he were a reputable member of the crow community.

On September 7, a boy brought me a living crow that he had winged;

its upper mandible was bent in the middle at right angles nearly and pointed downward, crossing the other, which was straight at one side. I kept it alive to see how it fed; it was able to pick up bread from the floor, but at each bite it had to turn its head, with the crown to the ground; when killed it proved to be quite fat.

On June 6, 1884, at Binscarth, on the Upper Assiniboine, I found a crow's nest in a bluff of poplar trees. It was in a crotch of a large poplar, about 8 feet from the ground, and was one of the most beautiful specimens of bird architecture I ever examined, excluding, of course, all pensive nests. It was a large structure of sticks, twigs, and bark strips, with a very deep cavity lined with fine fibers and beautifully finished off with a coating of cow's hair. It contained four eggs.

Ha ha sen: The crow. These birds are plenty inland but seldom appear on the coast. * * * This bird is migratory. (Hutchins MSS., Observations on Hudson's Bay, 1782.)

163. *Dolichonyx oryzivorus albinucha*. Western Bobolink. White-naped Bobolink.

Carberry: Specimens are referred by Mr. Ridgway to the form *albinucha*, therefore I assume this to be the form throughout. Common summer resident on the prairies; at Pembina, breeding in large numbers, and westward along the boundary to the mountains (Coues). North to Selkirk Settlement (Ridgway). Winnipeg: Summer resident; abundant (Hine). Stony Mountain: In every little bluff of aspen or willow the beautiful rice bird (*Dolichonyx oryzivorus*) was seen or heard (Hine). Ossowa: Breeding (Wagner). Oak Point: 1884, arrived May 23 (Small). Portage la Prairie: Common summer resident; arrives about the 20th of May; departs the end of September; in 1884, first seen, June 1; last seen, July 22; at this date they were changing their plumage and gathering into flocks (Nash). Carberry: Common summer resident near Turtle Mountain; near Long River (Thompson). Dalton: 1889, first seen, five, on May 22; breeds here (Youmans). Quite common on the prairies in Manitoba, from Grand Valley to Cypress Hills (Macoun). Shell River: 1885, first seen, one, male, on May 18; next seen, ten, on May 24; is common all summer and breeds here; nest with six eggs found (Calcutt). Qu'Appelle: Tolerably common summer resident; breeds; arrives May 15 (Guernsey).

July 25, 1884: Bobolinks still in breeding plumage at Carberry, although at Portage la Prairie I noted them changing three days ago, but early in August the change takes place, and Bob discards his motley and bells. The play is over, the clown of the pantomime lays aside his license and livery, and, like many real clowns out of dress, he is a very serious character. He is now silent, or only utters a metallic "*klink*" and goes very intently about the very prosaic business of finding out where, with least trouble, he can get the largest meals.

The Bobolink (*Dolichonyx oryzivorus*) is of course common. I saw birds in both the black and buff plumage together at Carberry on August 30. (Christy.)

Towards the end of July, after breeding, these birds collect into large flocks, and the old males change their plumage. They then leave the prairie and attack the oat fields, doing, with the assistance of the Grackles and Redwing Blackbirds, an immense amount of mischief. After the oats are cut they resort to the marshes, feeding on wild rice, etc., until the cool nights inform them it is time to leave. (Nash, in MSS.)

164. *Molothrus ater*. Cowbird.

Abundant summer resident throughout the prairie regions. Abundant at Pembina and westward along the boundary to the mountains (Coues). Red River Settlement on 28th April (Blakiston). Winnipeg: Summer resident; abundant (Hine). Oak Point: 1886, arrived April 14; 1885, first seen, one, on April 15; is common, and breeds here (Small). Ossowa: Breeding (Wagner). Portage la Prairie: Common summer resident; altogether too abundant; with the same parasitical habits in nesting as elsewhere; arrives about May 25; departs in the early part of October (Nash). Carberry: Abundant summer resident on the prairies; Souris River, May (Thompson). Common everywhere on the prairies (Macoun). Shell River: 1885, first seen, five, on May 14; afterwards seen every day all summer; is common; lays eggs in the nests of the Song Sparrow and Yellow Bird (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives April 20 (Guernsey).

I noticed that on the Big Plain the cowbirds disappear for a time, apparently joining the rusty grackles and other species among the swamps and wet lands until after the attainment of the fall plumage, when for a time they again became conspicuous, and continue about the pastures until October.

165. *Xanthocephalus xanthocephalus*. Yellow-headed Blackbird.

Common summer resident of the deeper sloughs of the prairie regions. At Pembina, breeding abundantly; Turtle Mountain and Mouse River at the boundary (Coues). Dufferin: Arrived between April 25 and 30 (Dawson). Winnipeg: Summer resident; abundant (Hine). Shoal Lake: May 15, 1887, very abundant (Christy). North to fifty-eighth parallel, but not to eastward of Lake Winnipeg (Richardson). Ossowa: Breeding (Wagner). Oak Point: 1884, arrived May 5 (Small). Portage la Prairie: Common summer resident; arrives about May 1, departs early in October; in 1884, main body arrived May 6; some few came before this (Nash). Prairie Portage (Hind). Carberry: Rare summer resident; Brandon (Thompson). Two Rivers: 1885, first seen, two, on May 1; fairly rare (Criddle). Dalton: 1889, first seen, two, on May 4; next seen on May 10, when it became common; breeds here (Yumans). Abundant around pools and marshes from Pembina to Winnipeg, in sedgy ponds, west to Moose Mountain; not noted in Winnipegosis region (Macoun). Shell River: 1885, first seen, one male, on May

1; next seen, four males, on May 3; is common here all summer and breeds, nesting in the bullrushes (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives April 18 (Guernsey.)

The voice of this bird is somewhat like that of the redwing, but is more varied, and in many of its intonations presents such a curious resemblance to the human voice as to suggest the possibility of its learning to articulate words. Its distribution is regulated by the amount of sedgy marsh in a neighborhood; thus, south of Winnipeg it is exceedingly abundant, and at Portage la Prairie it is very common; but in the immediate vicinity of Carberry it is the least common of the blackbirds. In its nesting and general habits it somewhat resembles the redwing, but is more terrestrial and less disposed to haunt willow sloughs.

Arrives about May 1; departs early in October. A frost just sufficient to form a thin coat of ice on standing water, on the night of October 6, 1884, drove out the whole army of these birds and all kindred species that roost in the reeds of the sloughs. I watched them in to roost that evening, as usual, but at daylight the next morning they had gone, leaving only a few straggling grackles behind.

Does not occur east of Long Lake, a sheet of water about 22 miles west of Winnipeg, near which city I could not find it or hear of it, although the country seems to be just suited to its want. (Nash, in MSS.)

166. *Agelaius phoeniceus*. Red-winged Blackbird. Soldier Blackbird.

Abundant summer resident, frequenting the willow-edged sloughs. Pembina (Coues). Common at Red River Settlements (D. Gunn). Red River Settlement on April 26 (Blakiston). Dufferin: Arrived between April 15 and 20 (Dawson). Winnipeg: Summer resident; abundant (Hine). Ossowa: Common; breeding; 1885, first seen, one, on April 25; next seen on April 26; became common April 28 (Wagner). Oak Point: 1884, arrived April 14; 1885, first seen April 18, next seen April 19; is common and breeds here (Small). Portage la Prairie: Common summer resident; arrive about April 15; depart early in October, though in 1885 a small party remained here until nearly the middle of November, long after everything was frozen up; they frequented my garden, feeding on the sunflower seeds; when these were exhausted I saw no more of them; in 1884, first seen April 22 (Nash). Very common in willow ponds in the Winnepegosis region (Macoun). Carberry: Abundant summer resident; breeding near Shoal Lake, west (Thompson). Two Rivers: 1885, first seen, several, on April 16; next seen, April 17; became common, with two other species, April 18 (Criddle). Dalton: 1889, first seen, one, on April 13; next seen on April 15, when it became common; breeds here (Youmans). Shell River: 1885, first seen, thirty-one, on April 13; afterwards seen every day, male and female, in flock; common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives April 18 (Guernsey).

June 11, 1882: Went in the morning with two brothers to the lake in the sand hills east of De Winton; saw there large numbers of Marsh

Terns and various kinds of blackbirds. I was unable, from the depth of the water, to reach the place where the terns seemed to be nesting, but found the nest of the Red-winged Blackbird in a few twigs that projected about a foot above the water, here 3 feet deep, and some 10 feet from the shore. I saw the female leave the nest, so that the identification is good. The male did not put in an appearance at all. The nest is very deep, neat, and strong; it is suspended from about a dozen upright twigs and is built much like that of a Baltimore Oriole, but entirely of grass. The eggs, four in number, were all fresh; one was 1 by $\frac{11}{16}$, pale blue, and scrawled over with most curious hieroglyphs in brown-black ink; the others were similar.

On August 9, 1884, while at Humphrey's Lake, I noticed that in the redwing colony there, although females and young birds were very numerous, only one male was to be seen. It would seem that the males leave the scattered breeding places and repair to the great marshes at this season and later on the females follow with the young.

This curious habit is said to belong also to the Boat-tailed Grackle (*Quiscalus major*), while the late summer disappearance of the cowbirds may be a propensity somewhat similar in its nature.

During the courting season the male Redwing may be seen approaching the female in most beseeching attitudes and giving vocal expression to his feelings from time to time, while his wings are slightly raised and the gorgeous patch of scarlet feathers on the shoulder expanded so as to appear thrice as large as under ordinary circumstances. Doubtless he is as much indebted to the latter as to his vocal appeal for the ultimate success of his suit.

The usual note of the species is a short, harsh "*chick*," but it is often heard to utter a shrill whistle, during which I have seen the bird dashing straight across the field or marsh with a flight so steady and swift that I have sometimes wondered for a minute what bird it was.

The "song" of the Redwing is a sort of guttural squeal; it has been happily syllabilized as "*conk-que-ree*." The effect of this, when uttered by what seemed to be a million voices, as I heard it among the reed-beds of Portage la Prairie slough, is not unmusical, and to the naturalist is pleasing in its significance of the multitudinous life about him, though it must be confessed that the granivorous propensities of this and all other blackbirds leave little chance of the farmers finding a similar enjoyment in the pleasant aggregation of unpleasant individual notes.

Shortly after the end of August all the species disappeared from here, but in such large reed-beds as that mentioned above they gather in thousands and linger until the frost drives them south, about the middle of October.

167. *Sturnella magna neglecta*. Western Meadow Lark. Prairie Lark.

Abundant summer resident of the prairies. East to Pembina (Ridgeway). Pembina, and westward along the boundary to the Rockies; com-

mon (Coues). From 60 miles south of Red River Settlement (Blakiston). Dufferin: Arrives between April 25 and 30 (Dawson). Winnipeg: Summer resident; abundant (Hine). Ossowa: Common breeding; 1885, first seen on April 6; next seen April 15; became common on April 19 (Wagner). Shoal Lake (Gunn). Shoal Lake: May 16, 1887 (Christy). Oak Point: 1884, arrive May 17; first seen, one, on April 9; next seen on 10th; became common on 13th; breed here (Small). Portage la Prairie: Common summer resident; arrives about April 10, departs about the middle of October; in 1884, first seen, April 15; in 1883 saw it in March (Nash). Carberry and the Big Plain, generally, to the Fingerboard; common summer resident near Turtle Mountain, Brandon, Milford (Thompson). Abundant on the prairie along the route marked; not seen in the Winnipegosis region (Macoun). Two rivers: 1885, first seen, one, on April 16; next seen, April 17; fairly common; breeds (Criddle). Dalton: 1889, first seen on March 26; next seen on March 28, when it became common; breeds here (Youmans). Shell River: 1885, first seen, one male, on April 12; a common summer resident, and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives April 5 (Guernsey).

April 17, 1882: The prairies are showing brown in places, and snow-banks are settling and losing their whiteness, through the grass that begins to show through them. Three Meadow Larks alighted on the fence to day, quite near to me, and one of them delighted me by vociferating his short rich song with a beauty I never before heard.

April 18: On Sunday we saw a few Meadow Larks about; on Monday the number was increased and an occasional jingle was heard; but to-day (Tuesday) at dawn scores of larks had appeared, and, as if by concert, all together burst into an explosion of splendid song, gushing out their rich, strong warblings from every little height and perch, singing with all their might; singing, as if under pressure; sing they must; perched on a fence, perched on a clod, running on the ground or flying high in the air, they sing and *must* sing aloud for the spring; singing they saw the dawn and the noon and the evening, and still they sang on till night came and the prairies were hidden in darkness, then for a while they ceased; but the rising of the yellow moon above the eastern fringe of trees was loudly hailed by many of the joyous birds and greeted with a renewal of this morning's burst of song.

April 27: Fall of snow last night, but this morning it changed to rain, and by 10 a. m. no snow remained. A Meadow Lark contrived to sing in all the pelting shower; he was not 100 yards from the door; so I took the telescope, paper, and pencil and made a sketch of him.

May 5: Took special notes on the position of Meadow Larks while singing to-day. Altogether, I observed twelve that were in full song; of these, nine were singing on trees, two in the air, and one on the ground. Their song, when on the wing, is entirely different from that

while perching; it is more like the prolonged trilling of the English Skylark.

June 4: Found a Meadow Lark's nest about 3 yards from the nest of a Prairie Chicken. This latter I had frequently visited, so that the lark had probably watched me on several occasions from a distance of only 2 or 3 yards, and yet had not betrayed her charge by flinching, and most likely I would not have found it had I not chanced to step nearly on it. This nest now contained young ones. I watched them until June 17, when I found they had flown.

On June 2, 1883, I saw four Meadow Larks all fighting, and at the same time singing in the air together. It was a curious competition and lasted for a minute or more; then down into the grass they dived en masse, there to continue for several minutes their noisy battle for the mastery. Possibly one of the number may have been a female, for whose favors the rest were competing.

On July 30, Miller Christy shot a young Meadow Lark, a male; stomach filled with insects, apparently all coleoptera; it had very little yellow on the breast, and the crescent was represented only by a few streaks. On its breast was an ulcer that nearly reached the bone; apparently it had been caused by a barb of a wire fence, against which the bird must have flown within the last fortnight.

Plain south of Shoal Lake, June 22, 1867: In passing over the plain we shot a Meadow Lark. These birds are found in pairs along the Red River to the end of the plains, and on the south side of the Assiniboine. They appear in pairs in May, generally perched on a low tree, willow, or reed. They are very watchful, seldom allowing the hunter the chance of a fair shot. (D. Gunn.)

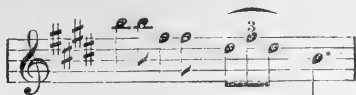
THE SONG OF THE PRAIRIE LARK.

[Reproduced from the American Magazine, April, 1887.]

How often and often we hear the hackneyed statement, "America has none but scentless flowers and songless birds," and how invariably we find that it proceeds from persons whose ideas of birds and flowers are gathered wholly from books and magazines, and these chiefly of European origin! There are many able writers ready and willing to do justice to the beauty and the fragrance of our numberless wild flowers, but those whose opportunities and dispositions enable them perfectly to observe and completely to record what of bird-song comes within their ken are few in number. For this reason I wish to give publicity to my observation of the Western Meadow-lark—the sweet singer of the plains, and the most gifted of American feathered musicians.

For years the skylark of England was my familiar friend, and his glorious song was my daily joy. Many times have I heard the famed nightingale singing by moonlight and by daylight in the shady woods of Saffron Walden, in Essex, and nearly all the noted songsters of England became more or less familiar during a sojourn of several years as a stranger in my native land. Then came a change that brought

Or one yet more characteristic:



And also, as the season advances, by a third and longer chant:



These bars, reproduced on a flute, will suggest with fair accuracy the mere notes of the song; but they can not suggest the bleak prairie scene nor the blizzard that fails to drown the singer's voice; nor the long, silent months gone by, without which the life and meaning and true feeling of the stirring call can not be understood.

As the full springtime comes on, the number of these short chants is greatly increased, whilst their prolongations and variations are without number; and soon it becomes evident to the most casual observer that the love-fires are kindling, and that each musician is striving to the utmost of his powers to surpass all rivals and win the lady lark of his choice. On one occasion, as I lay in hiding near a fence, three larks came skimming over the plain. They alighted within a few yards of me, and two of them burst into song, sometimes singing together and sometimes alternately, but the third was silent. When at last they flew up I noticed that the silent one and one of the singers kept together. I had been witness to a musical tournament and the victor had won his bride.

Nor does the love-fire languish after mating; for now the lark is inspired anew, and springing up from the grass he soars high in the air and pours forth a rhapsody that seems to flood the very plains with sound—ringing and bursting; richer far than song of nightingale; prolonged like the skylark's melody; wild with passion and fire, and more varied than tongue or type can tell. Often have I tried to record the changing bars of music, but never with any but the most trilling success. A few of the notes were caught, but the volume of the song was far beyond the power of symbol or staff to represent. Commonly the refrain began with a part nearly thus:



succeeded after several repetitions by another:



All after that was a torrent of melody beyond any mode of expression at my command, until the final bar with flute-like clearness is rendered and repeated :



and then the singer sails downward to the prairie where sits the one for whom alone was meant this passionate strain.

There is yet one more type of song with this bird. It is a prolonged tender warbling, quite unlike the far-reaching chants, for it is so low and soft that at a hundred yards distance it becomes inaudible. I have heard it only a few times, and then it was uttered by the male bird, standing on some low perch not far removed from the nest where his less musical though not less beautiful mate was brooding.

Throughout the nesting season the air-song and the gentle conjugal refrain may be heard in full strength, for love is the life of their melody; but after the young have flown these are heard no more, though still the shorter lays are uttered daily and hourly from the few low perches offered by the prairie.

During the heat of summer, when other birds are hushed, the Prairie Lark continues in song both by day and by night; and even when chill October draws nigh, he still lingers on the prairies and warbles in the brown grass with much of the power and sweetness of springtime. The latest seasonal observation that I have of the bird was of one singing a farewell to the already snow-whitened plains late in October, after which he took wing, and I watched him till out of sight in the southern sky.

How comes it that this prince of songsters has so long continued almost unknown? Why are we of the new world so heedless of our native singers? Had such a voice been brought forth in Italy, its praises would have furnished a worthy theme to many a noble pen:

And Ovid, could he but have heard,
Had hung a legendary pain,
About the mention of the bird.

True, I find on reference to standard works of natural history brief notes in connection with our bird, such as "One of the most delightful voices of the prairie" (Coues); "Impressed by its wonderful beauty of song" (Brewer); "Their songs are lively, sweet, and varied; they sing at all seasons, early and late, from the ground, from the tree-top, and in the air" (Cooper); "Highly musical, contending even with the mocking-bird for supremacy in song" (Lieutenant Couch); "In the depth of its tone and the charms of its articulation its song is hardly excelled" (Ridgway).

And yet so inadequate is the power of mere words, that, though I had previously read these opinions, I was wholly taken by surprise when

first on the prairies of the Assinaboine I heard the voice of the Meadow-Lark of the West.

One writer compares it with the rich-voiced wood-thrush; another, with the gifted mocking-bird, and again parts of its song have been likened to the soft warbling of the blue bird. But nearly all of this qualified praise is from the pen of passing travelers, few of whom have, like the writer, spent season after season with the bird, hearing its spring greeting and its fall farewell, resting so near to its nest as to hear its vesper warble, its midnight song of peace, and its salute to dawning day. Few have actually witnessed the song contests of the rival birds, and fewer still have overheard the soft consoling lay of the male to his sitting mate.

In listening to each of these varied effusions again and again, I have been peculiarly fortunate, and each season spent on the prairies has intensified the admiration I felt for our bird; for, though indeed it will not compare with the skylark in continuity of inspiration, it is second to nothing else. In richness of voice and modulation it equals or excels both wood-thrush and nightingale, and in the power and beauty of its articulation it has no superior in the whole world of feathered choristers with which I am acquainted. The more I heard of its melody the deeper was the admiration with which it inspired me, until at length I have learned to look on our lark as the noblest of bird-musicians, and the very incarnation of the wild, free spirit of the West.

No bird is more characteristic of the prairies than the Meadow-lark (*Sturnella neglecta*). It is very common in summer and breeds abundantly. Its clear, musical whistle (almost, if not quite equal to the song of the nightingale) is uttered by the bird either when upon the wing, the ground, or a tree, and may be heard for a great distance. Towards the end of August, though the birds had not left, they had largely ceased whistling; but the arrival of a few warm days, about the 10th of September, set them off again for a time. When I left, about the middle of October, there were still a few small family parties about, though the great majority had gone south. It is decidedly a shy bird, even in a country where most birds are notably less wary than in England; and, common as the bird is, it is no easy matter to obtain a specimen just when one wants. Late in July I shot a young specimen with a large festering sore on its breast, doubtless caused by its having accidentally flown against a spike on one of the numerous "barb-wire" fences on which this bird frequently perches. Not long after I shot a Purple Grackle with an old wound on its head, which was probably occasioned by the same means. I have often thought what a capital thing it would be to introduce the Meadow Lark into England. So far as plumage and song are concerned, it would take rank among our brightest colored and most admired songsters; while its hardy nature would allow of its remaining with us the whole year round, as indeed it often does in Ontario and other districts farther south than Manitoba. Perfectly harmless and accustomed to grassy countries, it would quickly become naturalized in our meadows, where it would find an abundance of insect food, and would doubtless soon increase sufficiently in numbers to serve, if need be, as a game and food bird, as it largely does in the United States. No other songster that I ever heard equals this bird in the sweetness and mellowness of its notes. (Christy.)

168. *Icterus spurius*. Orchard Oriole.

One male specimen, June 6, 1873, at Pembina, the only locality where observed (Coues).

169. *Icterus galbula*. Baltimore Oriole.

Common summer resident of open woodlands in the south and west. Abundant at Pembina; breeding; the only locality where found along the line (Coues). Winnipeg: Summer resident; abundant; found not quite so far north as the Rose-breasted Grosbeak (Hine). Oak Point: 1884, arrived May 25; 1885, first seen, one, on May 19; is common and breeds here (Small). Ossowa: Common; breeding; 1885, first seen, two, on May 15; next seen on May 17; became common on May 19 (Wagner). Portage la Prairie: Common summer resident; arrives about May 20; in 1884, first seen, May 27 (Nash). Carberry: Common summer resident (Thompson). Very common in woods around Lake Manitoba (Macoun). Shell River: 1885, first seen, one male, on May 16; next seen, four, on May 18; is common here all summer and breeds (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives May 18 (Guernsey).

On June 25, 1882, on the north bank of the eastern slough, I found a Baltimore Oriole's nest in an oak tree, about 10 feet high. As I was climbing the tree the female bird flitted about, uttering a loud, harsh chatter; as she often came close to my head I had good opportunity of viewing her graceful form and rich yellow plumage, and I thought her the most beautiful bird I had ever seen, until a moment later her splendid mate flashed into view on an adjoining bough, and stood there blazing in the sun. He was much less bold than his mate, and did not chatter in the same way, but uttered a loud "*puhee*" like a fragment of his song.

This nest was about 4 inches deep. It was formed of the outer bark of the *Aselepias*, and so thoroughly interwoven and "darned" that the fabric was like a thick warm felt. It was remarkably strong, too, and with a view to testing it in this particular I brought it home with the branch that bore it, and, having hung to it a pail by a band across the upper surface, proceeded to add weight. Fifteen pounds was gradually added without its showing any signs of breaking, but at the seventeenth the weight slipped to one side, and being thrown upon but one of the fastenings, broke it. I then procured another nest, an old one of the same material, and tried it successively with 15, 20, 25, 27 pounds, and still it held together; 29 and 30 were reached without breakage, but at 31 it began to give, and after a few seconds the weight tore through the fabric, without, however, injuring the fastenings at the top.

On October 19 found an old nest of an oriole down by the slough. It was woven of strips of *Aselepias* bark and suspended from four or five twigs. I made a careful test of its strength and found that it bore

15 pounds weight without the least sign of breaking, but an additional 2 pounds, thrown carelessly on, tore it from its fastenings.

170. *Scolecophagus carolinus*. Rusty Blackbird.

Enormously abundant migrant. Pembina (Smithsonian Institution) (Blakiston). Very abundant at Mouse River, on the boundary, after the second week of September (Coues). Dufferin: Arrives before April 15 (Dawson). Morris: April 29, 1887 (Christy). Ossowa: 1885, first seen, one, on April 8; next seen on April 16; became common April 20; last seen, about twelve, on October 24 (Wagner). Very abundant during the spring migrations, and again from August to the middle of October; arrive about the 10th of April; some of these birds may remain to breed in this locality, but I have not found them so engaged (Nash). Very abundant on Swan River in September, 1881 (Macoun). Carberry: Extremely abundant in the migration; Rat Portage: October (Thompson). Severn House; Trout Lake Station, the most northerly species (Murray).

April 15, 1882: Snow still deep everywhere, but melting fast. In the poplars along the slough side to-day was a large flock of Rusty Grackles. They were singing together their loud, jingling, spring notes, and the sound was like a chorus of innumerable sleigh bells.

April 21: The thousands of Grackles have been increased to tens of thousands. They blacken the fields and cloud the air. The bare trees on which they alight are foliated by them. Their incessant jingling songs drown the music of the Meadow Larks and produce a dreamy, far-away effect, as of myriads of distant sleigh bells. Mixed with the flocks of Rusty Grackles now are a few Red-winged Blackbirds.

171. *Scolecophagus cyanocephalus*. Brewer's Blackbird. Satin-bird. Blue-headed Blackbird.

Abundant summer resident. Pembina (Kennicott). Abundant along the boundary, from Pembina to the Rockies; breeding (Coues). Winnipeg: Summer resident; abundant (Hine). Ossowa: Common; breeding (Napull). Carberry: Abundant summer resident; breeding. Big Boggy Creek: Common; breeding (Thompson). Portage la Prairie: These birds commit fearful depredations in the oat and wheat fields after the grain is ripe, particularly if grown near the woods or a marsh (Nash).

On June 8, 1882, C. T. found a grackle's nest on the newly harrowed ground in a field not more than 20 yards from a clump of willows. The eggs, five in number, were in a slight hollow in the ground, without a single straw or any pretence at lining. My brother sprang the bird and then called me. I did not see the bird rise, but a pair of grackles were flying about and noisily resented our interference, and as no other birds were near, I feel safe in the identification.

On June 21, while walking by the south slough, I came upon two grackles that were at great pains to inform me that their nest was close

at hand, and also that my presence was most unwelcome. I at once set about seeking the treasure house, and found my ablest assistants in the birds themselves, for, as little children playing at hide and seek, direct each other by crying "hot" or "cold," so these grackles guided me, ceasing their clamor somewhat as I receded, and redoubling their outcries when I approached the site of their nest. In this way I soon found it. It was placed on the ground in the open, sheltered only by a few weeds; it was a bulky structure, composed chiefly of roots, but lined with hair. It contained three eggs of the grackles and one of a cowbird. I have never before heard of a cowbird intruding its foundling on a species larger than itself.

September 18, 1882: September is going fast now; in the early mornings the sky has a cold steel-blue look along the horizon, and the clouds that come up are white and lumpy looking. We are expecting frost soon, for many signs announce that the fall is here and passing quickly. Already the grackles are gathered in the immense flocks in which they migrate, and are even now moving southward. We thought them numerous in the spring, but they seem to be ten times as plentiful now. The sound of their wings as they arise or fly overhead is like the noise of rushing breakers; it is not at all like thunder, as some have described it, but resembles the rattling *shr-a-a-ay* of surf on the shingly beach. The murmur is so continuous as to suggest the roar of a waterfall, and, as in that, there is a beat in this, thus: *shrá-rá-rá-rá-rá*, etc., making the resemblance still more perfect. Their loud *crek-crek's* also combine to form a great sound; it does not unite with noise of the wings, but remains sharp and separate on the vaster volume, just as the black dots and wriggles sometimes seen on their eggs remain separate and contrasting with the purple mottlings, though occupying the same ground.

This grackle is generally distributed throughout the Assiniboine Valley. It arrives and moves so constantly with the Rusty Grackle that it was but lately I learned to distinguish them, and my previous impression on the subject of their specific distinction negatived the value of a number of observations.

The dozen of nests of this species which I have examined were all either on the ground or in low forks or saddled on logs, close to some pond, and were more or less composed of mud when elevated. I found half a dozen nests around a single small lake on the Duck Mountain. The eggs are in color between those of the Rusty and Purple Grackles.

172. *Quiscalus quiscula æneus*. Bronzed Grackle. Crow Blackbird.

Abundant summer resident wherever there is both wood and water. Abundant at Pembina; breeding; Mouse River (Cones). Winnipeg: Summer resident; abundant (Hine). Red River Settlement (Gunn). Ossowa: Breeding (Wagner). Oak Point: 1884, arrived April 10; 1885, first seen, two, on April 16; next seen on April 18, when large

flocks came; is common and breeds here (Small). Portage la Prairie: Very common summer resident; arrives about April 15, departs early in October, the first frost hard enough to form ice driving them out; first seen in 1884, April 16 (Nash). Very abundant about ponds in the Northwest (Macoun). Carberry: Common summer resident; breeding; Duck Mountains; common; breeding (Thompson). Dalton: 1889, first seen, four, on April 8; next seen, April 12, when it became common; breeds here (Youmans). Shell River: 1885, first seen, seventeen, on April 15; next seen, a hundred, on April 22; became common on April 24; male and female in flock; common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives April 25 (Guernsey). In September I found the Crow Black-bird sparingly (along Nelson River) between Hudson's Bay and Lake Winnipeg; also westward, except about the little cultivated ground at Norway House and Cumberland, after which (October 4) are not seen (Blakiston).

On May 1, 1882, W. Brodie shot into one of the immense flocks of grackles that frequent the stubble field, and brought down sixteen Rusties and one Bronze at a single discharge. The Bronze was so little hurt, being slightly grazed on the wing, that his death sentence was commuted to imprisonment in a nail keg under strict surveillance. As he manifested a cheerful and intelligent disposition he was soon allowed the additional privilege of making himself a veritable nuisance in every corner and department of the house, and so thoroughly and assiduously did he apply himself to take the fullest advantage of this liberty that every one but myself was thankful when, after a few days of pretended resignation, he took the first opportunity of skipping out of doors for good. My observations on this bird were much as follows: He would eat anything that was eatable, but preferred flesh. A mouse he would hold in his claws and devour exactly in the manner of a hawk, swallowing each morsel as it was torn off by his bill. This sanguinary taste, I fear, points to a nest-pilfering propensity that I am sorry to admit.

I never before saw a wild bird take so readily to captivity. Within two or three days he became quite at home in the kitchen, and perfectly familiar with the place and purpose of the water pail. He had a curious way of hanging downwards from the rim when the water was low, so as to reach it, and he never failed to search for the pail whenever he desired to drink. I often detected in the croaks and cries he uttered a peculiar, almost human, *timbre*, that suggested the possibility of his learning to articulate words. From the first he exhibited a magnificent development of impudence and vanity. He would pose in the sun and admire the effect of it on his really splendid plumage, till one would suppose he thought he was the Bird of Paradise itself, instead of merely a very distant relative. Altogether, in spite of his troublesome disposition, his playful ways and general cuteness made me so fond of him that I was heartily sorry when poor Jack disappeared.

173. *Coccothraustes vespertinus*. Evening Grosbeak.

Common winter visitant; possibly nesting. Winnipeg: Tolerably common winter visitor (Hine). I have never seen this bird myself here during the summer months, but have noticed them in the autumn, winter, and early spring at Selkirk and Big Island, on Lake Winnipeg; the half-breed who was with me at Big Island told me that they were at Selkirk all the year round (R. H. Hunter). Portage la Prairie: Abundant winter visitor from October 15 to about May 16; Winnipeg, less common; Riding Mountain, in December (Nash). Shell River: 1885, seen February 20 (Calcutt). Qu'Appelle: Common winter visitor; large flocks seen in February and March (Guernsey).

Mr. Hine tells me that this bird is very abundant about Winnipeg in the winter and spring. It is usually seen in the groves of soft maple, on whose seeds it feeds. Its note is like that of the Pine Grosbeak, but shriller, and resembles the syllables "*cheepy-tcet*." He says it is known by the name of Sociable Grosbeak, as it is always seen either in pairs or in small flocks.

This bird is an abundant winter visitor at Portage la Prairie, where the first generally appear about the 15th of October. From that date they continually increase in numbers until the 1st of December, when they reach the maximum. Whilst here they frequent the Northwest Maple or Box Alder, feeding on its seeds, and seldom visit the ground, except in spring, when they will sometimes crowd thickly on a bare spot, apparently seeking small gravel for digestive purposes.

During the winter they are usually to be seen in small parties, not exceeding six or eight in number, but early in April they congregate into large flocks, in which the males preponderate; they are then restless, frequently rising from the tops of the trees and flying about high in the air in circles over their haunts. They remain here until about May 16, when they all disappear together.

In view of the fact that this bird's nest has never been found, it may be worth noting that the Pine Grosbeak, its invariable associate in the winter, whose nest and breeding place is known, leaves here about the end of March, whilst the Evening Grosbeak remains in its winter quarters six weeks later, from which I would infer that it should not go so far from its winter haunts to nest as does the Pine Grosbeak.

On the 13th December, 1884, I saw a flock of these birds in the Riding Mountain, and observed them every day after that until the 20th, when I left. I did not find them nearly so common on the Red River as at Portage la Prairie. (Nash, in MSS.)

174. *Pinicola enucleator*. Pine Grosbeak.

Somewhat common winter visitant; possibly nesting in the northern woods of spruce. Winnipeg: Winter visitor; tolerably common (Hine). Red River Valley: Rare and accidental near Winnipeg; plentiful in spruce east and north of Winnipeg (Hunter). Swamp Island: 1885; rare; migrant; seven observed November 6; last seen November 7 (Plunkett). The Pine Grosbeak was frequently seen on the Churchill River in the end of July, showing that it probably breeds in this region (Bell, 1880). Portage la Prairie: 1890; common winter visitor; arrives about the 1st of November, departs about the middle of March; feeds largely on the seeds of prairie plants projecting above the snow; ob-

served in the Riding Mountains, December, 1884 (Nash). Red Deer Lake, 1881 (Macoun). Carberry: Common winter visitor (Thompson). Brandon: January 24, 1883, and February 22 (Wood). Shell River: Winter visitor (Calcutt). Qu'Appelle: Common winter visitor; large flocks seen all winter (Guernsey). Severn House (Murray).

On November 9, 1882, among the eastern sand hills I shot a Pine Grosbeak which had perched on the top of a tall spruce tree; female; length $9\frac{1}{2}$, extent 14; gizzard filled with what I took for spruce seeds. The bird was uttering a loud whistle from time to time.

On December 6, at the spruce bush, saw several Pine Grosbeaks flying singly or in twos and threes; they seemed to be feeding on the tops of the poplars. This was about sunset.

December 7, at the spruce bush in the morning, I shot a Pine Grosbeak, female, and saw a fine red male.

175. *Carpodacus purpureus*. Purple Finch.

Summer resident; in small numbers on Turtle Mountain during the latter part of July; doubtless breeds (Coues). Winnipeg: "Pine Finch," summer resident; tolerably common (Hine). Portage la Prairie: 1890; common summer resident; arrives about April 20, departs about October 15; contrary to my experience in Ontario, I find that here the full plumaged crimson males are the first to arrive (Nash). Swan Lake House: July 11, 1881; doubtless breeding (Macoun). Carlton House: May, 1827 (Richardson). Carberry: Tolerably common in spring; in fall at Portage la Prairie (Thompson). Shell River: 1885, first seen, one male, on April 30; next seen, four, on June 3; a transient visitor, passing north and not remaining any time or breeding (Calcutt).

On May 14, 1883, I shot an adult male Purple Finch in full song. Everywhere tinged with crimson except the belly, which was white, and the rump, which was yellow; even the gizzard and all its contents were stained a rich crimson. It had been feeding on poplar catkins.

176. *Loxia curvirostra minor*. American Crossbill. Red Crossbill.

Winter visitant; possibly also breeding. Winnipeg: Tolerably common (Hine). Red River Valley: Permanent resident; abundant in any spruce bush (Hunter). Saw one female that was taken at Gladstone in the fall of 1885 (Nash, 1890). Carberry: Winter visitant (Thompson). In Minnesota very abundant; breeding; I never saw it out of the pineries (Trippe).

In Manitoba I failed to detect its presence excepting during the winter and spring. It generally appears in the Carberry woods with the snow and thenceforth throughout the winter; it is common wherever there is plenty of spruce and tamarac, for the seeds of these are its favorite food.

177. *Loxia leucoptera*. White-winged Crossbill.

Winter visitant; possibly resident and breeding. Winnipeg: Tolerably common (Hine). Carberry: Winter visitor (Thompson). Severn House and Trout Lake Station (Murray).

On December 6, 1882, at the spruce bush, 35° below zero, shot three White-winged Crossbills out of small flock that was feeding on the cones of a tall spruce. These were all males.

178. *Acanthis hornemanii exilipes*. Hoary Red-poll.

Migrant and winter visitant. Winnipeg: Rare; winter visitors (Hine). Specimens taken at Carberry in the early winter from a flock of the *Acanthis linaria* (Thompson). *Linota borealis*, Severn House (Murray).

179. *Acanthis linaria*. Red-poll.

Abundant fall and winter visitant. Winnipeg: Tolerably common in the migration (Hine). Portage la Prairie: Abundant winter resident arrives about October 20; departs about May 1; observed in the Riding Mountains, December, 1884 (Nash). Carberry: Abundant in the fall migration (Thompson). Shell River: Winter visitor (Calcutt). Qu'Appelle: Common; arrives April 1 (Guernsey).

On October 25, 1882, saw a couple of red-polls about the barnyard. They were feeding on the cottony crests of the solidagos.

On November 3, shot three red-polls; one was a female, crimson on poll only; gizzard filled with various small seeds. These appear to be *Acanthis exilipes*.

On November 6, a flock of red-polls appeared and were feeding on the weeds near the barnyard.

180. *Spinus tristis*. American Goldfinch. Wild Canary.

Common summer resident. Noted only at Pembina (Cones). Winnipeg: Summer resident abundant (Hines). Oak Point: 1884, arrived; May 29 (Small). Portage la Prairie: 1890, arrives about May 25; common summer resident; departs about the end of September (Nash). Carberry: Common summer resident; abundant in August and September (Thompson). Shell River: 1885, first seen, one male, on May 24; next seen, two, June 3; is common all summer; breeds (Calcutt). Qu'Appelle: Tolerably common; summer resident. Arrives May 24; breeds (Guernsey).

September 9, 1884. The goldfinches are now going southward in large flocks. For the last month they have led a roving life in bands of both sexes; especially frequenting fireguards and old breakings, where there is usually a luxuriant growth of prairie sunflowers (*Gaillardia*), whose seed is a favorite food.

In Manitoba I have not noted the bird before the end of May. In

this country it finds neither thistles nor orchards, so it feeds largely on the seed of the prairie sunflower (*Rudbeckia hirta*) and Gaillardia (*G. pulchella*), and nests in the low poplars and oaks on the edges of the heavier timber.

About the end of August they gather into roving bands of both sexes and feast on the now abundant supply of sunflower seed; about the 10th of September they disappear.

181. *Spinus pinus*. Pine Siskin. Pine Linnet.

An irregular migrant. Winnipeg: During June it is found along the Red River in hundreds (Hine). 1890: Rare and irregular visitant; I saw two or three flocks near the Red River in September and October, 1886 (Nash). Carberry: Irregular spring and fall migrant; not common (Thompson). In Minnesota observed in great numbers in the fall; migrates south in winter (Trippe).

On December 5, 1883, at spruce bush, saw a large flock of small birds swoop on the top of a birch tree, then an instant later sweep off again and wheel off twittering into the woods. I took them for Pine Linnets.

182. *Plectrophenax nivalis*. Snow-flake. Snow Bunting. Snowbird.

Very abundant early spring; fall and winter residents. Winnipeg: Very abundant winter visitant; seen as late as June 10 (Hine). Red River Settlement in winter (Blakiston). Swampy Island: 1885, first seen, two, on April 4; next seen April 13; last seen May 1; is tolerably common in fall and spring; does not breed; first seen in fall, twenty, on October 12; after this it became common; 1886, first seen, eight, on March 29; bulk arrived April 8; last seen, April 18 (Plunkett). Shell Lake: 1885; winter visitor (Calcutt). Portage la Prairie: Abundant winter resident; arrives about October 10; departs usually about the middle of April (Nash). Manitoba House, 18th October, 1858, snowbirds were flying about the post in large flocks (Hind). Abundant on the prairies between Brandon and Fort Ellice in October, 1881 (Macoun). Carberry: Abundant from November 1 to April 30, or usually as long as there is any snow (Thompson). Qu'Appelle: Common winter visitor; leaves about May 10 (Guernsey). Severn House, Trout Lake Station: Only goes to the south when the snow becomes deep (Murray).

Dauphin Lake, October 7, 1858, snowbirds were seen for the first time during the afternoon. They came about our camp in large flocks, but they did not appear to have quite assumed their winter dress.

In Manitoba, perhaps more than in any of our southern provinces, the hardihood of this most hardy bird may best be seen. As soon as the snow falls the snowbird appears in force, and all winter long he continues to twitter cheerily about the cheerless outbuildings and forage among the litter of the barnyards. The snow comes deeper and the weather gets colder, till the thermometer seems settled to sleep away

down among the 20's below zero, and still the merry, rollicking snow-birds roost on the barn and twitter and enjoy life ; laugh and grow fat they surely do. Many that I have taken at this season are like balls of butter, and the clouds of blinding, biting, stinging snow that career over the desolate plains seem no more to them than a summer zephyr. The winter aspect of the prairie is dreary enough to our eyes. But when the winter storm—the blizzard—arises, burying the land in snowdrifts and destroying life with a gale of wind chilled to 50 or 60 degrees below zero, it may well be wondered that the hardiest of animals are left alive, so terrible is the power of this overwhelming torrent of snow.

Then it may be asked, when the blizzard is over, was the snowbird out in all this ? He was certainly not in ; and yet he was in, for his enemy is his friend. The deadly snow saved him alive from itself ; he was not killed, but buried. He had indeed descended into the grave to save his life, for like several other birds that brave the northern winter, he has learned to crouch during a snowstorm in some recess or hollow, and his warm, protecting counterpane is the snow.

It is said that no bird goes farther north than the Snow Bunting. With him, if with any, is the secret of the Pole. In that desolate land where higher beings can not live, the young snowbird is reared in peace, like a frail flower springing up in the very cave of death. The sentiment of the strange construction is fully illustrated by a sight recorded on Southampton Island, by Captain Lyons, the explorer. Cold and hunger had swept away a tribe of Esquimaux ; their bodies lay about what was once a village ; on the shore, half buried by the sand, was the the body of a child, and on its breast a snowbird had built its nest and was rearing its young.

These abundant winter birds arrive at Portage la Prairie about October 10 ; depart usually about the middle of April. Their movements being influenced greatly by the weather, so long as the ground is covered with snow they will remain, but as soon as the bare ground is visible they disappear.

A few pairs may remain to breed with us, for on the 23d of May, 1884, I surprised a pair of them drinking out of a tub in my garden. The day was very warm, and after they flew on the fence I noticed that they seemed oppressed with the heat ; their beaks were held open as one sometimes sees our common birds holding theirs on hot days in August. On the 22d day of June I saw one of the same pair or another bird also in my garden eagerly hunting for food, but unfortunately I lost sight of it without tracing it to its nest, if it had one. (Nash, in MSS.)

183. *Calcarius lapponicus*. Lapland Longspur.

Very abundant spring and fall migrant wherever there is prairie or cleared country. Mouse River, October (Cones). Dufferin: Arrive before April 15 (Dawson). Winnipeg: Abundant migrant (Hine). Abundant at Rat Portage, October, 1886 (Thompson). Portage la Prairie: Common in the spring ; sometimes abundant in autumn (Nash). Very common on the plain at Fort Pelly, and on the road between Fort Ellice and Brandon, during September and October (Macoun). Car-

berry: Enormously abundant in the spring, and less so in the fall migration; plains south of the Souris River; abundant in spring (Thompson). Cumberland House, late in May. (Richardson). Trout Lake Station and Severn House (Murray).

On May 13, 1882, while crossing the Barren Plain south of the Souris River we met with immense hordes of longspurs, thousands and tens of thousands of them; flock after flock, or rather wave after wave, in the flood that seemed never entirely to cease passing over. On all sides, as far as the eye could reach, they were to be seen stretching away into dim distance, like swarms of bees or gnats. Each wave of the flood seemed to fly on low over the plains for a short distance, and then settle on the ground to run about and forage among the bunch grass while the next wave passed overhead. But, in all their flights and changes of front and pace, one thing was noticeable, they kept a steady onward movement to the north. They are chiefly of two kinds, the preponderating species, the Lap Longspurs, and the next in numbers, the Black-breasted or *C. ornatus*, and the last the Painted Longspurs, scarcely represented at all.

September 6, 1883. The fall flower, the gentian, has just come out in great numbers. As I crossed to a part of the prairie where I might see their exquisite blue in perfection, a small flock of longspurs rose from my feet, uttering a doleful whistle. Two sad signs these; both say plainly, summer is gone and fall is short and passing away. Even now these longspurs were flying from the frost, and as often as I put them up they flew, not haphazard, but before me, or over my head, always to the south; every move must help them in their journey to their winter home.

May 15, 1884: The Lap Longspurs are here again in thousands. High in the air they fly in long straggling flocks, all singing together, a thousand voices, a tornado of whistling. Over the prairie they go, on to the newly sown fields, and here the flock drops a feeler, a sort of anchor or pivot, around which the whole body swings; then lifting again their anchor they wheel about and perform two or three evolutions, again drop the anchor and at length form a dense close column, and ceasing whistling they swoop down to the field to forage. When sprung they rise in a dense body, but at once spread out and begin the merry whistling. It is a peculiar sound of multitudinous melody, but not loud, and in some respects like the sleigh-bell chorus of the blackbird.

In the heat of the day these birds may be seen sitting in long rows in the shadow of each post in the fence; as the sun moves around they keep edging along to avoid his rays. They do not seem to like the heat and no doubt will soon go.

May 16: Very warm, 87° in the shade. Saw on the prairie a strange bird that might have been a female longspur, excepting that it had no white on the tail that I could see.

May 17: Enormous flocks of longspurs are still to be seen about the

newly sown fields. The gizzards of those I opened were full of oats, wheat, buckwheat, and grass seed. There are two species, the Lap and the Painted Longspurs. Grangers, the farmers here call them indiscriminately. The merry chee-chupping of the Laps, and the sweet singing of the richly colored Painted Longspurs make a continuous melody, like the spring jingling of blackbirds, but with more of the tone of bobolinks. Both sing on the ground. None of the specimens taken showed any anatomical signs of sexual excitement, so that they probably go much farther north to breed.

About the middle of May every year the Lap Longspur comes to this country, associated with the chestnut-collared Painted Buntings, in enormous flocks, coming in May, just after the crops are in. They do a great deal of damage, picking up first the seed that is exposed and afterwards tearing it up when it begins to sprout. A large number that I shot about this time had their gizzards full of oats, wheat, hayseed, and buckwheat.

When in the fields they have a curious habit of squatting just behind some clod, and as their upper colors are nearly matched to the soil, they are not easily observed, nor will they move until you are within a few feet; they then run a few feet and squat again, unless closely followed so that they must fly.

When in the air they move in great straggling flocks, all whistling together, so there is a perfect tornado of song. Merrily they fly along to the new-sown fields; then the ragged flock drops a feeler, an anchor or a pivot round which the whole army wheels, and after performing two or three evolutions in close column, finally cease whistling and swoop onto the field to forage. When "sprung" they rise in a dense body, but soon at once spread out and begin the merry jingling, a sound of multitudinous melody somewhat like the noise of Blackbirds.

In the heat of the day (for we often have it over 80° F. during May, shade register) they may be seen sitting in the shadows of the fence posts, in each shadow a long group just the size of the post, and as the shadow moves they will edge round to avoid the sun.

As the middle of May passes the jingling music becomes louder and more vigorous. The effect of a large body of longspurs singing is somewhat similar to that of a small body of bobolinks. They (*pictus* and *lapponicus*) now sing both in the air and on the ground. The song of the *lapponicus* is like "*chee-chuppy chuppy*" repeated with short intervals; the *pictus* has a more pretentious song. The latter went north about the 20th of May, in 1884; the former remained until about the 1st of June.

They retire to the far northwest to breed, but return again during the last week of September. They remain on the stubble fields for about two weeks before migrating southward. Their numbers now are much less than in the spring migration, contrary to what might be expected.

184. *Calcarius pictus*. Smith's Longspur. Painted Longspur.

Abundant spring, but rare fall migrant; one in Smithsonian Institution from Pembina, September (Kennicott). Mouse River (Coues). Carberry: Extremely abundant; migrant; staying for about two weeks in spring, and returning for a few days in the fall (Thompson). Severn House: Seems scarcer than the others; Sir John Richardson mentions that he had only obtained one specimen; three have been sent to me (Murray).

May 13, 1882, on the plains south of the Souris River, a few Painted longspurs were observed with the immense flock of Lap Longspurs that are now passing northward.

May 17, 1884, Carberry: The Painted Longspurs are here now in enormous numbers, accompanying the Lap Longspurs. They sing a sweet continuous song while perching on a clod. To-day I went out to collect a few out of the vast flocks that are daily about the newly sown fields; northwest wind was blowing and I approached from the east, but I could not detect a bird on the ground, although I was springing them from my very feet at each step. They have a habit of squatting closely when approached, then springing up they fly off with undulating flight; and as during this it is not easy to collect the bird, I got no specimens until it occurred to me to go around and approach the flock from the west. As soon as I did so the whole field seemed alive with the longspurs; their gay bosoms were thickly speckling the dark earth for acres, and I had no difficulty in getting as many as I needed.

Although in full song I could detect no signs of amatory passion in these birds, so that no doubt they go very much farther north to breed.

185. *Calcarius ornatus*. Chestnut-collared Longspur. Black-breasted Longspur.

Common summer resident; local in distribution, many pairs sometimes affecting a limited area of dry prairie, while again for miles no more of the species are to be seen. Wonderfully abundant; breeding along the boundary from 20 miles west of Pembina Mountain to Montana (Coues). Winnipeg: Summer resident; abundant (Hine). Shoal Lake, May 16, 1887 (Christy). Portage la Prairie: 1890, a colony about 2 miles north of here (Nash). Breeding in numbers on the Souris Plain, between Brandon and the Brandon Hills and southwesterly, late in June and early in July, 1881 (Macoun). Great numbers south of the Souris on the Brandon Trail, a colony at Chater, and another in the Big Plain near Boggy Creek (Thompson).

May 15. Camp 30 miles south of the Souris, over the same monotonous rolling prairie, a succession of ridges with duck-ponds in the hollows between. The Black-breasted Longspurs are still very numerous, though much less so than they were two days ago, and are now mostly seen in pairs. The males are frequently seen to spread their pretty black and white wings and tails and rise in the air about 10 feet, where they

sing sweetly for a minute or so; then, having let off the ebullition of feeling that prompted the action, they drop to the ground to chase their mates, or to resume the more humble vocation of foraging, mouse-like, among the bunch grass. There seemed to be a vast colony of them breeding at this particular place, but after moving a few miles further on none at all were to be seen.

On June 2, 1884, on a barren ridge of the rolling prairie between Boggy Creek and Petrel, I found a colony of over a dozen pairs of Black-breasted Longspurs. I did not succeed in finding the nest, as my visit to the place was merely in passing through "per cart," but I was able to make a number of observations on their song and habits. I found them rather shy of allowing approach, but quite indisposed to cease whistling on account of the intrusion. I was surprised to see them frequently perch on low bushes and sing there, also on the ground; so that some ecstatic singer would perhaps start his song as he squatted on terra firma, then spring up, singing in the air, and finish the performance on some willow bush. The song was somewhat like that of a bay-wing, but with a more mellow warble and without the slurred notes. The accentuation I noted down from the bird's dictation, as follows: "*Weeo-weecchup-e-we-chipity-tr-r-r-r-r-r-r.*"

Specimens shot had their gizzards full of grass seed and small insects of all sorts, but chiefly coleoptera.

When sprung they had a habit of rising abruptly and flying with deep undulations for about 100 yards, when they would pitch down again. On going to the place they would be found to have run some distance, and would again spring from a totally unexpected quarter.

186. *Poocætes gramineus confinis*. Western Vesper Sparrow. Baywing.

Very abundant summer resident on the prairies. Breeds in abundance from Pembina westward along the boundary to the Rockies (Coues). A specimen from Red River Settlement in Smithsonian Institution (Blakiston). Winnipeg: Common summer resident (Hine). Portage la Prairie: Common summer resident; arrives about May 10 (Nash). Common on the prairies, from Brandon westward (Macoun). Carberry: Abundant summer resident; breeding also along all the trails in the prairie region towards Brandon and Fort Ellice. Shell River: Breeding (Thompson). Shell River: 1885, first seen, two, on April 29; is common all summer, and breeds here (Calcutt).

May 11, 1882: Traveling to-day on the old Brandon Trail. As we follow its windings over the sterile prairie about Fairview, large numbers of Vesper Sparrows are to be seen, running and hopping in and out among the tufts of bunch grass, or flitting just ahead of the horses, which they seem to think are pursuing them. This is the first time I have observed them, but they are in extraordinary numbers here.

On May 9, 1883, shot a Vesper Sparrow, singing at dusk; a male; length $6\frac{1}{4}$, extent 11; gizzard full of grass. In the evening, after

dusk, a strange small sparrow ran along the ground before me, uttering a long twittering song in a quiet, cheerful way. I expected a discovery, but found it was only my old friend the baywing. I subsequently heard this effusion a number of times; it is like a soft continuous whispering of extracts from his various other musical performances. It was a male; length $6\frac{1}{2}$, extent 11; gizzard full of grain.

On July 31, 1883, at Humphrey's Lake with M. C., we noted a small bird that rose in the air singing a song like that of the English Lark, but less powerful. It sang and soared to a height of about 40 feet, then sank again to the grass. After an eager pursuit it was secured and proved to be only a Vesper Sparrow.

On August 4, 1884, heard a sparrow making a continuous screeching noise. It proved a baywing. In its bill was a grasshopper, and its gizzard was full of insects. Three times this week have I heard the baywing singing its air song from aloft. These are the only occasions noted this year, and now the species is not singing its ordinary song at all. Last year, as near as I remember, it was the samely.

Like its eastern relative this bird has a habit of running and flying by turns on the path, or a few feet before one. I have watched the conceited little creature when it chanced to alight on the trail, just in front of a train of over a hundred emigrant wagons, that, with a great herd of cattle and a rabble of boys and dogs, under guidance of noisy drivers and mounted outriders, presented a most formidable array half a mile in length, and the little baywing kept hop-hopping along in front and watching back over his shoulder; or if the leader approached him too closely, he would take a short flight and continue on the trail hopping, and seem all along to say "Catch me if you can, you folks; you are following hard and I am much amused." Then when at last he left the trail and the crowd passed on, he seemed to congratulate himself on having outwitted them so cunningly; or it may possibly have been that he thought he was the leader of the whole train, for I have also seen him when the train turned off at forks flit across the narrow point of land and again resume his task of leadership, much after the fashion of modern newspapers and politicians that are supposed to be the leaders of public opinion.

Another peculiarity of the species is its fondness for a dust bath. It will squirm and rustle its plumage and splash about in a dust heap for half an hour at a time, evidently enjoying it hugely. On a small sandy spot by the house door I used daily to see from one to six baywings enjoying their dry wash, but very rarely any other species.

In some of its habits it presents a considerable difference to the eastern bird, being in my opinion a much more accomplished songster, although superior opportunities for studying this bird may have influenced my preference for its music.

During the months of July and August he ceases his usual vesper scng, and vents his feelings in a loud, wild, lark-like chant, which is

poured forth as the bird rises high in the air. An English friend, on first hearing it exclaimed that it was the voice of a real skylark, but it proved shorter and weaker. The bird begins to sing as he leaves the prairie, and sings and soars till he has reached a height of 50 or 60 feet, when he again returns to earth.

This air song is not heard nearly as frequently as the common perching song is in its proper season, nor have I heard both at the same time of year. The perching song alone is heard during May and June, and again after the fall molt there is a renewal of the spring chantings—an aftermath of song—for the bird ceases his soaring lay and once more sings for the setting of the sun.

This has an interesting bearing on the theory that many species often become perforce air singers on betaking themselves to prairie life.

But the song that this species utters late in the day is its sweetest if not its supreme effort, at the time when the reddening sun is nearing the horizon when, as the prairie farmers say, it casts no shadow; when, in reality, the ground is all in shade of the low ridges to the west. A bird on the prairie is in that shadow, but on springing up in the air the ruddy glow falls on him as he faces the setting sun and renews the song he sang for his rising. So springs and sings the Meadow-lark and many other ground birds, and having vented their feelings in this last good-night, sink down into the night which is already on the ground. Then, as the sky darkens, the eastern colors become those of the west, and the east grows somber, the general acclamation dies away, but the Baywinged Bunting sings on cheerily as ever, and is commonly left to sing alone in the gloaming loud as in the daytime, but seeming twice as loud. The peaceful notes are poured forth till the whole prairie seems lulled by the sweetness of the strain. This is the vesper song—this is the Vesper Bird.

The little baywing (*Pooecetes gramineus*) is one of the most familiar of prairie birds, and nightly sings a subdued kind of vespersong as the sun goes down. Its most notable peculiarity, however, is its habit of flitting along a trail or pathway in front of an advancing wagon or person, alighting every few yards. As it is but comparatively recent that there have been any human trails over the prairies, it seems probable that this proceeding is a relic of a habit acquired by the bird of flitting before the buffaloes along the paths made by those animals. (Christy.)

187. *Ammodramus sandwichensis alaudinus*. Western Savanna Sparrow.

Abundant summer resident on the prairies. Breeds in profusion from Pembina westward, along the boundary to the Rockies (Coues). One from Red River Settlement in Smithsonian Institution (Blakiston). Winnipeg: Summer resident; abundant (Hine). Portage la Prairie: Common summer resident (Nash). Red Deer River and Manitoba House (Macoun). Carberry: Abundant summer resident; breeding in all prairies near Rapid City, near Bartle, Silver Creek, Rat Portage, October (Thompson).

On June 18, 1882, within a few feet of a straw stack in the barnyard,

where horses and cattle are continually running about, I found the nest of a Savanna Sparrow, protected only by a tuft of prairie grass. It contained five eggs, and was composed of grass with a meager lining of horsehair, the whole being slightly sunk in the ground.

June 29, Rapid City: All this spring I have been puzzled by a peculiar simple little song that was uttered by a small insignificant-looking sparrow, which usually perched on the top of a low bush in a dry grassy locality. This afternoon I succeeded in shooting one of these birds in the very act, and was somewhat surprised to find that it was a Savanna Sparrow, a bird that I was otherwise very familiar with. The song is readily suggested in my mind by the phrase "*tship e tship-e-tship-e-screetship.*"

Soon after arriving it may be seen on nearly every little willow bush on the Big Plain, repeating its short ditty, with the simple earnestness that characterizes the Scrub Sparrows. Its voice is much sweeter than that of the Shattuck Bunting (*Spizella pallida*), but it must needs finish with the inevitable "buzz." The song is shaped somewhat like "*tship-e-tship-e-tship-e-screetship.*" This is uttered for hours together with untiring diligence, and yet withal a lack of improvement that would seem to explode the old adage, "Practice makes perfect."

This bird is remarkably shy, even in places where man is scarcely ever seen.

188. *Ammodramus bairdii*. Baird's Sparrow.

Abundant summer resident throughout the Assiniboine Valley, wherever there are alkaline flats. One of the commonest birds, and doubtless breeding along the boundary on the prairies westward of Pembina Mountain to Mouse River (Coues). Carberry, very rare; Fingerboard, rare; Shoal Lake, west, abundant; also at Birtle and Shell River (Thompson). A supposed specimen obtained at Moose Mountain, July 3, 1880 (Macoun).

On June 4, 1884, near Shoal Lake, west, shot a number of Baird's Buntings. They do not answer to Coues's description (1 Key). The crown is suffused with dull orange. Its song is very like that of a Savanna Sparrow. In many parts of the prairies west of Birtle there are low flat alkaline stretches sparsely covered with long wiry grass. Wherever the land is of this character Baird's Bunting is sure to be a prominent if not the prevailing species. It is now in full song, and its peculiar notes are to be heard on all sides. The song may be rendered *trick-e-trick-e-trik-eeee-chiky-le-roit*, with a peculiar utterance that at once distinguishes it from the song of Savanna sparrows. Another type of song with this species is like *trick-e-trick-e-trike e t-r-r-r-r-r-r-r-r-r*.

June 22, Shell River country: Here the dry alkali bottoms are more frequent, and the bunting is numerous in proportion.

June 24, Shoal Lake: Baird's Sparrow is common about here, though

less so than at Birtle. On the Big Plain where there are no alkaline flats; I have noted it but once or twice. The general habits of this bird are much like those of the Savanna Sparrow. While singing it is usually perched on some tuft of grass, each foot grasping a number of stalks to furnish support. When discovered, it flits low over the flat and drops into the grass. A number of the specimens taken were rather larger than the measurements commonly given.

189. *Ammodramus lecontei*. Leconte's Sparrow.

Abundant summer resident of willow bottom-lands in the Assiniboine boundary near Mouse River (Coues). Near Winnipeg: "Sharp-tailed finch;" summer resident; tolerably common (Hine). Carberry: Abundant summer resident; breeding in willow sloughs and grassy flats; Fingerboard; West slope of Duck Mountain, abundant; breeding (Thompson). Portage la Prairie: Rare summer resident in the large grass marshes near Portage la Prairie; may perhaps occur in larger numbers than is supposed, as it skulks in rank herbage and is difficult to flush, even with good spaniels (Nash).

In the afternoon of June 26, 1882, while riding after the cattle through the scrubby bottom land that skirts the eastern slough, I started a small sparrow from its nest. I dismounted and almost immediately found it; it was by a willow bush, and although apparently on the ground it was raised 6 inches or more above the wet by a matted tangle of twigs and grass on which it was placed. It was composed entirely of fine grass, and contained three eggs. The old bird hurried with rustling flight into the willow thicket and continued flitting about or threading the mazes of the copse, and uttering from time to time their peculiar and characteristic "*tweete!*" which was of that ventriloquial ambiguity that makes it difficult to place unless the bird is in sight. I had no gun, and knew I would not again be in that region for weeks, so I took the nest and eggs, not knowing the importance of the find. One of the eggs is $\frac{3}{4}$ by $\frac{1}{2}$, was of a delicate pearly pink before, pure white after blowing—with a few spots of brownish-black towards the larger end. I afterwards became quite familiar with Leconte's Sparrow and am satisfied that it was the species whose nest I found on this occasion.—E. E. T., 1885.

This beautiful sparrow abounds in Manitoba wherever there are meadows that offer the right combination of willow scrub and sedgy grass.

About the 5th of May it returns to the Big Plain. At first it is seen creeping about among the red willow scrub and last year's sedge along by the sloughs, and uttering a peculiar "*tweete*," whence I knew this species as the willow-tweet long ere I had heard of Leconte or of any scientific name for the bird. This note is one of these very thin, sharp sounds that are so misleading by their ventriloquial character that one does not know in what direction to look for the "tweeter." On first

seeing the species close at hand it strikes one as being much like a beautiful miniature of the Meadow-lark.

About the middle of May the male begins to "sing" on some low twig, projecting a little above the long grass on the slough. He takes his stand, grasping and keeping his perch with a fixity of manner that bespeaks immovable resolution. Presently he throws back his head, gapes his widest, and thus with bill pointing to the zenith, arduously laboring, he is delivered of a tiny, husky, double note "*reese-reese*," so thin a sound and so creaky that I believe it is usually attributed to a grasshopper, and yet he evidently toils hard and brings this forth with such unction that he is quite exhausted for a time and sits dejected until he recuperates, which he does in about ten seconds, and once again his little soul is huskily poured out and again exhausted nature asserts her claims, and he subsides once more for the ten seconds of needful rest; but the strain is too great to be kept up for any length of time, so after five or six rehearsals, from beginning to end without omission or abbreviation, he is in such a reduced condition that the notes are no longer audible at a distance of 20 feet. He now drops from his post of elevation to the lower world and devotes his energies to the accumulation of protoplasmic recuperation in the form of plant-lice, flies, and caterpillars.

It is interesting and amusing to compare the intense earnestness of the Scrub Sparrows in the utterance of their creaky notes with the cool, off-hand dash, the nonchalance of the Larks and Wood Thrushes when they are stirring hearts and echoes with their inimitable strains.


Another common note of this sparrow is a single, long-drawn "*bizz*," which also is deceptively like the sound of a grasshopper. This it repeats at intervals from some perch. When approached it drops into the long grass and threads about in the sedgy thicket like a Marsh Wren, although it is much less difficult to put up than that bird.

190. *Chondestes grammacus*. Lark Sparrow.

Common summer resident in vicinity of Winnipeg (Hine). Not noted elsewhere.

191. *Zonotrichia querula*. Harris's Sparrow.

Abundant spring and fall migrant, frequenting thickets. Mouse River, at boundary, September 19 to October 3 (Cones). Portage la Prairie: Common spring and autumn visitor; arriving about May 15, when they remain but a few days; reappear about September 20, departing about the 1st of October; whilst here they usually accompany the White-throated and White-crowned Sparrows, feeding in the rank weeds around the deserted half-breed claims (Nash). Fort Pelly: In flocks, 50 miles north of Brandon, west of the Assiniboine, on the road to Fort Ellice, October, 1881 (Macoun). Carberry: Abundant spring and fall migrant; Souris River (Thompson). Shell River: 1885, first seen, three, on May 15; a transient visitant; not breeding (Calcutt).

May 24: Black-hooded sparrows are here now in force. Many heard singing a bar like  one individual to this added a warble somewhat like that of a bluebird. The performance was disappointingly short, but the general impression gathered was, that whoever happens to hear the full song of the Hooded Sparrow will know one of the sweetest of bird melodies. During their spring visit the Blackhoods often uttered three clear whistling notes, and on one occasion a soft bluebird-like warble was added to this.

Soon after this date, May 24, they all disappeared as far north as the Duck Mountain; not one was to be seen in June. In the middle of October they once more return and abound for a few days. The young are now with them, but where hatched and under what circumstances is as yet entirely unknown.

192. *Zonotrichia leucophrys*. White-crowned Sparrow.

Migrant; probably breeding in the northeastern region. Winnipeg: Transient visitor; abundant (Hine). Oak Point: 1884; arrived May 5 (Small). Portage la Prairie: Tolerably common; spring and autumn visitor; arriving early in May; reappears about the 20th September; departs early in October; first seen, in 1884, May 15 (Nash). Carberry: Rare; spring and fall migrant (Thompson). It breeds in all parts of the fur countries, arriving in the middle of May and departing early in September to the northern parts of the United States, where it winters (Richardson). Common near Leaf River (Minnesota), where it breeds (Trippe). Severn House (Murray).

Cusa ba ta shish: White-crowned Bunting. * * * These birds appear in May and retire southward before the cold begins; make a nest of grass and feathers in a bunch of willow or grass; lay four eggs and sometimes five, of a dusky cast; the young fly about the beginning of July; their flights are short. When on the wing they are silent, but when perched on an elevated spot set forth a most melodious song. They feed on insects and seeds of grass, etc. (Hutchins MSS., Observations on Hudson's Bay, 1782.)

193. *Zonotrichia intermedia*. Intermediate Sparrow.

Abundant at Mouse River, at the boundary, in middle of September (Cones).

194. *Zonotrichia albicollis*. White-throated Sparrow.

Common summer resident of woodlands. Winnipeg: Transient visitor; abundant (Hine). English River and Cumberland House: Nesting near Lake of the Woods, May 29 (Kennicott). Portage la Prairie: Abundant; spring and autumn visitor; arrives about May 15; reappears in great numbers early in September and remains until late in October; the last were seen by me October 31, 1884 (Nash). Very common around Lake Manitoba; breeding at Manitoba House June 15 (Macoun). Carberry: Common summer resident; breeding; Shell

River; Little Boggy Creek; Duck Mountain, breeding; Rat Portage, October (Thompson). Shell River: 1885, first seen, a pair, on May 6; next seen, twenty-one, on May 19; a transient visitant (Calcutt). East of Lake Winnipeg (on Nelson River), till September 15 (Blakiston). Cumberland House, June 4, 1827: A female sitting on seven eggs (Richardson).

July 6, 1882, Shell River: This evening our camp was on the edge of that yawning crack in the globe at the bottom of which runs the Shell. As I walked along the edge, watching the setting of a red-hot sun that was sinking amidst clouds of purple fire, a small bird flew up from the gray woods, now in deep shadow, to the antlers of a dead tree, in full glare of the sun, and stirred within me a hundred latent memories with a song I had not heard for years. For a minute or so he sang; then dived down into the woods, again to be heard faintly and seen no more.

This is a song I have been familiar with from childhood; but I have never seen the singer close at hand, and have found no one who could tell me its name. I am now satisfied that it is not, as I was told by one, the Golden-crowned Thrush. I could have shot the bird on this occasion and so have gratified my longing to know, but a gentler feeling restrained my hand until it was too late.

On June 19, 1883, I found the nest of the peabody while wandering with a young friend in a brush slashing wherein were still a few standing trees. In a more than usually open part a heavy black spruce and a bright silver birch were wrestling together like two giant athletes. About the feet of the wrestlers were beautiful spear-shaped calla leaves in abundance, growing through masses of decomposed twigs—a tangle of the living and the dead—and from among these, in a drier spot, sprang the peabody's mate. The nest was a deep cup sunken in the ground among the black moss and decayed twigs. It was lined with black fibers, which made it more like its surroundings. The four eggs were mottled with a soft purplish gray.

October 7: Once more in the Shell River Gorge, where first in this country I heard the peabody. It was dark when we arrived, and a gloomy, cold autumn night. Except the rushing of the river and the hooting of an owl, the only sound is the soft whistling of the peabody.

This bird is so well known as a night singer that in many parts he is called the "nightingale," and I shall not be surprised to find that he also has an air song, and is therefore entitled to take rank as a singer of the first order.

May 15, 1884, heard a Peabody singing a song like this:



mud on the outside and straw or grass on the inside; makes choice of a situation in trees raised about a yard from the ground, and lays from two to five eggs, spotted with black. Also, "kaw sar bac ta pe tha shish" * * * This migratory bird is called the conjuring bird, because it begins singing just before the bad weather ceases, and forebodes an end of rain, etc., at which time its note is very clear, and seems to resemble the following words, "twēt, twēt, tiddlēt tiddlēt, tiddlēt," which it takes about a minute in singing. It makes its nest in willow, lays four eggs, brings forth its young about the middle of July. (Hutchins MSS., Observations on Hudson's Bay, 1782.)

In 1884 last seen by me at Portage la Prairie on October 31, feeding on the berries of the high bush cranberry (*Viburnum opulus*), there being 3 or 4 inches of snow on the ground at the time. These birds do not breed anywhere near either Portage la Prairie or Winnipeg. I looked for the birds very carefully each summer for 6 years but saw none. (Nash, in MSS.)

195. *Spizella monticola*. Tree Sparrow.

Abundant migrant; frequenting thickets; Mouse River, October (Coues). Dufferin: Arrived before April 15 (Dawson). Winnipeg: Summer resident; abundant; migrant (Hine). Portage la Prairie: Abundant spring and autumn visitor; arrives about April 10, remaining until about May 15; reappears about October 1, and departs about October 30, the last stragglers remaining until November 2 (Nash). Very abundant around brush on the plains in September (Macoun). Carberry: Very abundant spring and fall migrant; Rat Portage, abundant in October, 1886 (Thompson). Two Rivers: 1881, first seen, twenty, on March 23; next seen, April 6; migrant (Criddle). Shell River: 1885, first seen, fifty or more, on April 10; a transient visitant, passing north and not breeding or remaining any time (Calcutt). Lake Winnipeg (north end): September 24, 1857 (Blakiston). Severn House: This bird winters in the United States (Murray).

September 30, 1884: The Tree Sparrows are here again in flocks. The doleful spell is about beginning, but there is nothing doleful about the Tree Sparrows. Right merrily they chase each other from branch to branch on the leafless trees, twittering gleefully, and ever and anon, as they dash by in full career, bursts of their music may be heard, or perchance some member of the merry crew mounts a perch and lets us hear his full song—a song so sweet and varied that it is surprising to find his subgeneric brethren credited with nothing better than a prolonged twitter. It commonly frequents thick copses rather than trees, and its general habits would entitle it to be called Scrub Sparrow rather than Tree Sparrow. In the springtime it remains here long enough to let us hear its first attempt at a love song, then it disappears in the unknown north.

196. *Spizella socialis*. Chipping Sparrow.

One in Smithsonian Institution from Red River Settlement; also at Pembina (Blakiston). Winnipeg: Summer resident; tolerably common (Hine). Oak Point: 1884, arrived April 11; next seen on the 12th;

is common, and breeds here (Small). Portage la Prairie: Rare; summer resident; arrives about May 1 (Nash). Carberry: Rare; summer resident; breeding (Thompson). Qu'Appelle: Summer resident; breeds; arrives April 13 (Guernsey). Common in Minnesota (Trippe).

On June 6, 1884, found a nest (of chippy) at Portage la Prairie, containing three eggs. I have noticed that the song of this bird is in Manitoba different from that heard from the species in the East. (Nash, in MSS.)

This species is quite rare in Manitoba. The earliest record I have is April 10, 1882, but this was the only one seen at the time, and it was fully two weeks before others appeared. After the spring migration I lost sight of the species, but afterwards found it in full song at one or two places along the edge of the sand hills. It was seen only in three or four localities. These were generally dry, sunny openings on the edge of the woods. I found one nest in a low spruce tree, but I was too late, as the young birds had flown. The male bird is heard every morning in spring and early summer, uttering his characteristic, prolonged twitter from some high perch near his chosen bush. Another note of this sparrow is a short "chip," which is so commonly heard that it has given rise to the ordinary name of the species. The nest is almost invariably lined with horse hair, whence the other common name, "Hair bird."

197. *Spizella pallida*. Clay-colored Sparrow. Ashy-nape.

Very abundant; summer resident on scrubby prairies and half open lowlands. Very numerous about Pembina; breeding; Turtle Mountain and Mouse River (Cones). Red River Settlement (C. A. Hubbard and D. Gunn). Shoal Lake: May 18, 1887 (Christy). Portage la Prairie: Very abundant summer resident (not at Winnipeg); arrives about May 10; departs about September 15 (Nash). Lake Manitoba and westward, June 16 and 25, 1881 (Macoun). Carberry: In all scrub lands; very abundant summer resident; breeding twice each season; Souris River; Fairview; near Fingerboard; near Rapid City; near Birtle; Binscarth; breeding everywhere; very abundant on west side of Duck Mountain (Thompson). Shell River: 1885, first seen on May 18; is common all summer, and breeds here; nest with four eggs found (Calcutt).

June 28, 1882. Trail 15 miles west of Fingerboard; in the evening shot a Clay-colored Sparrow. The species is very abundant about here, and its peculiar grasshopper-like notes are heard from every patch of dry scrub land.

June 29, Rapid City: All spring I have been puzzled by a singular lisping song that is uttered by a small sparrow which frequents scrubby localities. The song, if it may be so called, may be represented by the syllables "scree, scree," sometimes repeated two or three times. I have at length shot one in the very act, and find that it is the Clay-colored Sparrow. This species is extremely abundant on the prairies from here to Carberry wherever there is any brushwood. Its usual occupation

seems to be to sit on some low twig and deliver itself of its husky notes every few seconds, with all the *empressement* of a full opera.

June 14, 1884, Duck Mountains: Our camp is in a bluff of low poplars and willows out in the prairie, which, however, is more or less scrubby. Here in the very early morning, before dawn, we are often awakened by the buzzing "*scree, scree*" of some near Ashy-nape, willing to be thought a nightingale. The species is remarkably abundant about here, so much so that I can easily find three or four nests of it in an hour or two.

On July 28, as I was writing by the window, a family of shattucks came rambling along, six in number, all young birds, colored like old ones, but streaked on the head and breast and tinged on the wings with a little chestnut. In the long weeds by the window they found a fine hunting ground and spent some time in hunting about, picking up a hundred things which I could not see at all. Now and then they would adopt the rôle of fly catcher, and one got badly scared by a great red butterfly that flew down beside him, but he soon recovered himself and turned the tables by attempting to turn butterfly catcher. Another member of the party was a Savanna Sparrow, who looked quite "bob-tailed" beside the Shattucks. The whole party continued rambling and foraging in this manner until at length they rambled out of sight. This seems to be the usual way for young birds to spend the last of their first season.

This small sparrow arrives in flocks about the 12th of May. Its small size and pale, ashy hue will generally identify it as it rambles over the scrubby parts of the prairie.

The song marking the pairing season begins to be heard towards the third week of May from a dozen points at once and ceases about the 10th of August. "Song" I call it for convenience, but it is the least musical of a number of indifferent performances and is much after the manner of Leconte's Sparrow. This bird mounts some perch and with head thrown back and with gaping beak utters a sound like a fly in a newspaper—"scree-scree-scree"—sometimes giving but one note and at other times, in the height of the season especially, repeating the dulcet five or six times. In the "intromission intervals" between performances, he sits immovably with the outward appearance and all the gravity of an uncommonly hard thinker.

The nest is usually finished by the last week in May, and at this time the males have such ample time for their music that the scrubby parts are resonant from dawn to dusk with their peculiar rasping "buzz."

The spot chosen for their home is mostly in a low bush, not more than a foot from the ground. As exception to this rule I have noted five nests on the ground and one or two at a height of 3 feet. It is a very slight structure, a good deal like that of a Chipping Sparrow, but composed entirely of grass. When compared with other tree nests it is conspicuously flimsy and light-colored, the latter effect being due to the

absence of the black fibrous roots so commonly used as lining. The eggs are among the most beautiful of any produced by the sparrows. When first the discoverer draws aside the brush and exposes the nest with its complement his feelings are as of finding an exquisite casket of jewels. Although this is one of the most common of our sparrows, and although on the scrubby plain between the Duck Mountain and the Assiniboine in early June, I could have found as many as four or five nests in an hour's walk, the treasure-trove feeling in connection with the eggs continues in full force.

I infer from the above and other observations that the Shattuck Bunting breeds twice, if not three times, each season with us. It leaves the "Big Plain" about the end of September.

198. *Spizella pusilla*. Field Sparrow.

Very rare summer resident. Red River Settlement: Breeding (D. Gunn). Winnipeg: Summer resident; tolerably common (Hine). Have seen it west of Winnipeg (R. H. Hunter). Qu'Appelle: Common summer resident; breeds; arrives April 15 (Guernsey).

199. *Junco hyemalis*. Slate-colored Junco.

Abundant migrant frequenting thickets and hillsides. Probably breeding in the Winnipegosis region, as it breeds in Minnesota (Trippe). Mouse River: At boundary in September; abundant (Coues). Dufferin: Arrived before April 15 (Dawson). Winnipeg: Transient visitor; abundant (Hine). Ossowa: Common migrant; 1885, first seen, two, April 7; next seen, April 16; became common April 20; went north about end of May (Wagner). Oak Point: 1885, first seen, April 3; next seen, April 4, when it became common; is common and breeds here (Small). Portage la Prairie: Abundant spring and autumn visitor; arrives about the first week in April, reappears early in September, and remains until November; the last straggler I saw was on the 5th of that month; it is somewhat strange that I could never find any of these birds breeding here, as I have several times found their nests in the province of Ontario (Nash). Red Deer River and Assiniboine River, July, 1881; probably breeding (Macoun). Carberry: Very abundant migrant in spring and fall; never seen in summer; Rat Portage, abundant in October (Thompson). Two Rivers: 1884, April; 1885, first seen, three, on April 6; next seen, April 17; migrant (Criddle). Shell River: 1885, first seen, one, male, on April 3; next seen, thirteen, on April 15; became common on April 24; male and female in flock; a transient visitant, passing north and not breeding or remaining any time (Calcutt.)

Towards the end of April they became very abundant; about that time, in 1884, there was some severe weather, with a fresh fall of snow, and the Juncos disappeared; but May-day proved a beautiful morning, and every copse and log-pile seemed alive with them and their comrades, the Tree Sparrows, which appeared to come from their various

hiding places; both species at first uttered a little "peet" from time to time, but when the weather became warmer two songs were repeatedly heard from the flock; one a sweetly varied strain from the Tree Sparrow, the other a twittering something like the ditty of the hair-bird, but stronger and more bell-like in the tone. This is the song of the Junco; whether it has or has not a more ambitious refrain reserved for the far away secluded dells of its birth I can not yet say.

About the middle of May, all the Juncos and Tree Sparrows disappear; not one remains; all go to the far north to breed. Even in the Duck Mountain, I saw not a single specimen during the summer.

Towards the end of September these two species return to the Big Plain, in mixed flocks as before, and continue about for a week or two, but ready to fly at the first intimation of really cold weather or snow.

This is the only species of our common sparrows that, when adult, entirely discard the streaked plumage, and the fact is perhaps due to its choice of breeding locality, for it alone frequents wooded hillsides, while its near relations are all found nesting more or less in grassy places, where their streaked plumage affords them a means of concealment.

The Towhee exemplifies a similar specialization; as its adult plumage more nearly assimilates it to the leaf-strewn ground where it lives, than would the streaky plumage of its youth.

About the second week in September the snowbirds or Juncos (*Junco hyemalis*) began to become abundant about Carberry and remained so for at least a month. (Christy.)

200. *Junco hyemalis shufeldti*. Shufeldt's Junco.

This form accompanies *hyemalis* in the migrations at Carberry (Thompson).

201. *Melospiza fasciata*. Song Sparrow.

Summer resident; chiefly in woods along water courses. One specimen, Turtle Mountain (Coues). Winnipeg: Summer resident; abundant (Hine). Southern shore of Lake Winnipeg; breeding (Kennicott). Norway House (Bell, 1880). Oak Point: 1884, arrived April 11; 1885, first seen, one, on April 13; next seen on April 15; is common and breeds here (Small). Portage la Prairie: Common summer resident; arrives about April 6; departs October 1; December 30, 1885, I found one wintering about the stables on a farm at Burnside; he seemed very happy, and sang as if his surroundings suited him (Nash). Common at Lake Manitoba in 1881 and on the prairies in brushy places near water; nearly always fall in the water when shot (Macoun). Carberry: Scarce; summer resident; breeding; Portage la Prairie, more common; breeding west side of Duck Mountain; breeding, Rat Portage, in October (Thompson). Shell River: 1885, first seen, five, on April 18; seen every day afterwards, becoming common on April 28; common

summer resident, and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives April 1 to 5 (Guernsey).

July 22, 1884, Portage la Prairie: Found the nest of a Song Sparrow with four eggs. The bird, which I shot, seemed a very small specimen. The nest was, as usual, close by a running stream. Three of the eggs were hardset; one was fresh; the ground color of the three was pale greenish, of the last a delicate cream-color; after being blown the creamy became of the same color as the others; one measured $\frac{9}{16}$ by $\frac{11}{16}$; it was heavily spotted as usual; the rest were similar.

This habit of sitting before the clutch is all laid seems common in the Northwest. No doubt the necessity for saving the eggs from frost induces immediate sitting, so that the young inevitably often appear of different ages. (Of. Kingbird, Vesper Bird, Robin, as well as Hawks and Owls.)

202. *Melospiza lincolni*. Lincoln's Sparrow.

Migrant in large numbers at the boundary on Mouse River, September 16, October 5 (Coues). Carberry: Rare spring and winter migrant (Thompson).

203. *Melospiza georgiana*. Swamp Sparrow.

Common summer resident; nesting in swamps that have some willows about them. Winnipeg: Summer resident; abundant (Hine). Oak Point: 1884, arrived April 24 (Small). Portage la Prairie: Abundant; summer resident; arrives about April 25; departs about 20th September (Nash). Mouse River, at the boundary, middle of September to second week of October (Coues). Carberry: Very abundant summer resident; breeding in every slough (Thompson). Qu'Appelle: Common summer resident; breeds; arrives September 18 (Guernsey).

To the Swamp Sparrows we are indebted no little for the merry twittering and the bustling signs of life about the brushy sloughs and reedy swamps of our country.

They delight in these damp thickets and may be seen continually scrambling around in the sedge and wet tangle or running on the floating reeds, holding "their skirts" very high, standing very high on their legs, with tails much raised, and otherwise showing great fear of getting wet. When they take wing, they flit over the water with rustling flight and tail rapidly pumping up and down; they usually make for the nearest bush or tussock, and then appear to tumble into it with nervous haste.

While flying and climbing about in the sedge, they often utter a short chirp, which is readily distinguishable when once heard, but can not be described in a way that would assist in its identification.

The commonest song of this species is a simple rapid, "twet-twet-twet-twet-twet-twet-twet-twet-twet," all in the same note and so

rapidly as to be almost a twitter. This is uttered at intervals from some dead branch projecting above the rest of the copse. If not disturbed the singer will sit quietly on this perch for an hour, repeating his ditty once or twice a minute, but if approached or alarmed he drops into the tangle, and so eludes both eye and gun. The bird is plentiful in the Northwest, and every willow-fringed slough is ringing with their song, so that I can not understand Dr. Coues writing "The song I have never heard."

Nuttall describes the song as a simple twitter, and this is not wrong; but it is long since I learnt to affix a note of interrogation to the statement commonly made of many of our passerine birds, "a simple twitter is its only note!" Something else is sure to turn up. Why, Wilson said that of the Vesper Bird! In the gloaming, after sundown on the 20th of May, 1884, I was strolling along the edge of a desolate-looking green and brown slough, when suddenly a small brown bird arose out of the sedge, singing in air so sweet and tender, yet strange, that I stood rapt. I never thought of shooting; soon the unknown melody was over and the air song finished with the familiar twitter of the Swamp Sparrow.

There was a time, not long gone by, when nearly all the birds were strangers to me, and whenever a new singer was heard or seen I felt something like a shudder, a perfect thrill of delight and anxiety. As I learned and knew them one by one, these extreme feelings came less often, for it was only a stranger that had such power to move, and on that evening, the first time for long, I was deeply moved by the voice of an unknown bird. Once or twice afterwards I thought I heard short bursts of song from the Marsh Wrens that sounded like fragments of the same strains, but I am inclined to think that the mysterious and delightful songster was the Swamp Sparrow, whose "only note is a simple twitter."

This song resembled the evening chant of a baywing, but was softer and possessed the charm of weirdness that might have been derived largely from the circumstances and surroundings.

204. *Passerella iliaca*. Fox Sparrow.

Migrant, not very common, breeding at Duck Mountain. Dufferin: Arrived between April 15 and 20 (Dawson). Winnipeg: Summer visitor, abundant (Hine). Portage la Prairie: Regular but not very common, spring and autumn visitor; arrives about April 22, reappears early in October, and departs at the end of the month (Nash). In woods on Duck Mountain, September 3; one shot at Livingstone September, 1881 (Macoun). Uncommon spring migrant at Carberry; abundant, breeding on the west side of Duck Mountain in June 1884 (Thompson). I observed it between Hudson's Bay and Lake Winnipeg (on Nelson River) in September (Blakiston).

June 19, 1884, Duck Mountain: The Fox Sparrow is quite common

here, and evidently breeding. Its loud ringing notes are to be heard on all sides among the timber on the mountain slopes and in the bluffs that dot the plain. Unfortunately, my efforts to find a nest were not successful. The habits of this fine bird exhibit much of the dash and style of the Wood Thrushes; it manifests a preference for the more open woods, and, when singing, is often perched on the top of some isolated tree.

205. *Pipilo erythrophthalmus*. Towhee.

Common summer resident in sheltered scrublands; not uncommon about Pembina, breeding (Coues). Winnipeg: Summer resident tolerably common (Hine). Northwest to Selkirk Settlement (Brewer). Oak Point, 1885: First seen, two on May 18, next seen on May 19; is common and breeds here (Small). Portage la Prairie: Common summer resident; arrives about June 1, departs about September 20 (Nash). Carberry: Common summer resident of dry, sheltered scrublands (Thompson).

On July 5, 1883, shot a Towhee female, length 8; the species is quite common along the dry, sunny, scrubby banks of the slough to the east. The common song is like "*Chuck-burr-pill a-will-a-will-a*," it has also a note like "*Twee* (not *Towhee*).

By August 30, the Towhee seems to have gone.

As Southern Manitoba is about the northmost region of this bird's distribution, full observations on its local habitat may result in conclusions of general interest on the subject, as the reasons for its choice of locality will probably be much more apparent than in its metropolis.

206. *Pipilo maculatus arcticus*. Arctic Towhee.

Along the parallel of 49 degrees this form becomes established, at least, as far east as the Mouse River, where I secured a specimen in September 16, 1873 (Dr. Coues).

207. *Habia ludoviciana*. Rose-breasted Grosbeak.

Common summer resident of thickets; breeding in abundance at Pembina (Coues). Winnipeg: Summer resident; abundant; found it as far north as Fairford (Hine), north to Selkirk Settlement (Brewer). Oak Point, 1884: Arrived March 26 (small). Portage la Prairie: Tolerably common summer resident, arrives about May 22. I found a nest June 7, containing two eggs; departs early, probably as soon as the young can fly; not found by me near Winnipeg (Nash). At Lake Manitoba and Red River abundant, probably breeding (Macoun). Carberry: Tolerably common summer resident (Thompson). Two Rivers, 1885: Saw one on May 25 (Criddle). Shell River 1885: First seen one male on May 14; seen every day afterwards; is common all summer and breeds here (Calcutt).

On June 28, 1883, in a spruce thicket among the sandhills, I noticed a large black and white bird, singing a song somewhat like that of the Oriole. The song was strong and spirited; on my nearer approach, the

bird disappeared in a tangled thicket, whence at times he uttered a peculiar "*churk*," as he threaded its mazes. I managed, however, to get a good look at him, and found he was a Rose-breasted Grosbeak.

On July 17, near the mill in the spruce bush, I shot a Rose-breasted Grosbeak, male, length 8, extension $12\frac{1}{2}$; stomach full of caterpillars small insects, and seeds. The species is not uncommon here.

208. *Calamospiza melanocorys*. Lark Bunting. Buffalo Bird.

Probably Manitoban; rare, noted on Souris Plain and west to Cypress Hills (Macoun). Moorseejaw, Northwest Territory, July 18, 1884. Buffalo Birds quite common (Miller Christy).

(The first of the above records refers partly to the extreme southwest of Manitoba, and may entitle this bird to a place in our list—E. T.).

209. *Piranga erythromelas*. Scarlet Tanager.

Rare summer resident in woodlands. Winnipeg: Accidental visitant at Fort Rouge, just across Main Street Bridge, I saw one specimen, a male, May 15, 1887, on the bank of Assiniboine River (Hine). North to Lake Winnipeg (Ridgway). "I saw one pair only about the 6th June, 1880, in township 13, range 1 east, where I camped for a day (it was the first and only time I had ever seen the birds, but my companion, Mr. Clementi-Smith, now of Brandon, who had lived several years in Ontario, told me he had seen several pairs on the shores of Lake Winnipeg), the pair were nesting when we saw them; they were within 20 feet of us for a couple of hours. Mr. Clementi had recognized their peculiar call, for half a mile before we saw them (R. H. Hunter). Qu'Appelle; occurs sometimes, but is rather rare (Guernsey). In Minnesota, common (Trippe).

210. *Progne subis*. Purple Martin.

Rare summer resident. Oak Point, 1884: Arrived May 19; scarce; 1885, first seen, one on May 17; next seen three on May 20; is common and breeds here (Small). Winnipeg: Summer resident tolerably common (Hine). Portage la Prairie: Scarce summer resident in 1884; first seen May 23; common since 1886; later and at Winnipeg (Nash). Lake Manitoba: Rare; one pair collected at Manitoba House (Macoun). Carberry: Rare, and not known to breed; Pembina River (Thompson). Two Rivers, 1885: First seen, two on May 26; next seen May 28, (Criddle). Turtle Mountain: Breeding (Cones). Shell River, 1885: First seen, one male on May 23; next seen, two more same day; not breeding, transient visitant only (Calcutt).

On May 18, 1882, at Pembina River, near Plum Lake: Found one or two hollow oak trees in a thin, scraggy wood, along by the river, that were tenanted by half a dozen pairs of Purple Martins. The birds

were seen entering in by holes that had evidently been made by the Golden-winged Woodpecker.

Since 1886 common in Portage la Prairie and Winnipeg during their breeding season. The first I ever saw in the Province arrived at Portage la Prairie May 23rd, 1884. There were two, a male and female. These birds bred, and after bringing their young out of the nest remained until August 23, when they disappeared. On the 13th of May, 1885, several pairs arrived and bred, departing as soon as the young could fly. Since that they have increased greatly. (Nash in MSS).

211. *Petrochelidon lunifrons*. Cliff Swallow, House Swallow, Eave Swallow.

Very abundant summer resident. Nesting about buildings; most abundant of the family, breeding at Pembina, and along the line westward to the Rockies (Cones). Winnipeg: Summer resident; abundant (Hine). "House Swallow" Ossowa (Wagner). Oak Point, 1884: Arrived May 22 (Small). Portage la Prairie: Common summer resident; arrive about May 16; depart usually the first week in August; in 1884, first seen May 17, (Nash). Portage la Prairie: Common along the river banks nesting in great numbers in Little Souris and Qu'Appelle Rivers (Hine, 1858). All along rivers in the Northwest (Macoun). Carberry: Rare. Brandon: Abundant. Shoal Lake, west: Very common. Fort Ellice: Abundant. Assissipi: Very abundant; breeding (Thompson). Shell River, 1885: First seen, eighteen on May 23; afterwards seen every day; is common all summer and breeds here under eaves (Calcutt). Qu'Appelle: Summer resident, breeds; arrives about May 10 (Guernsey).

On May 25, 1882, at Brandon, under an 80-foot barn eave that faced the south, and stood by the river, I counted fifty-four nests of the Cliff Swallow and the remains or foundations of many more; many were bunched together in tiers, two or more deep.

On July 4, at Fort Ellice, on the Hudson's Bay Company's buildings along the river, are large numbers of Cliff Swallows' nests. All the higher buildings the Sheltered River Valley have numbers of them under the eaves, but none of the buildings on the hills, or at the elevated fort, are ornamented.

On June 4, 1884, near Shoal Lake, west, saw above thirty Cliff Swallows' nests under the eaves of a house that stood near a small lake. The birds had evidently been in possession of their nests for some time, as they were thoroughly repaired, but very few had begun to lay.

June 6. Assissippi: Although the carpenters have scarcely finished the new mill, and hotel, over three hundred pairs of Cliff Swallows have begun to build under the eaves. The noise of such an extensive colony is discernible at a great distance, and is not altogether considered pleasant by the townspeople. The remarkably favorable circumstances that have called this colony so soon into existence are high walls in a sheltered hollow, with a sunny exposure and proximity to a sheet of water.

Mr. George A. Blake, of Edmonton, has sent me a photograph, taken in Fort Saskatchewan, which shows about five hundred Cliff Swallows'

nests on a single gable; in some parts the ranks on this photograph are fifteen deep.

Although taking possession of their nests as soon as they arrive, these birds do not begin to lay until 2 weeks later. On the 4th of June I examined a number of these mud bottles on an empty house, a little beyond Shoal Lake, and was surprised to find that although all were tenanted very few as yet contained eggs, and most of these only one. All of these large colonies are placed noticeably near some lake or river, and an examination of the gizzard of one shot at this last mentioned place, showed it to contain, besides flies, a large number of water beetles, so that when the bird is seen low skimming over the water and dipping its bill from time to time, it is, beyond doubt, more often feeding than drinking.

About the 23d of August the Cliff Swallows may be seen leaving the Big Plain in flocks.

The cliff swallow had built its nests in great numbers on the banks of the river (Assiniboine, at Portage la Prairie), which rose about 16 feet above the level of the water. I counted no less than thirteen groups of them within a distance of 5 miles, when drifting down in a canoe. The cliff swallow was afterward seen in great numbers on the Little Souris, the south branch of the Saskatchewan, and the Qu' Appelle Rivers. (Hine, 1858.) The colonies are increasing yearly. They soon establish themselves in every small settlement that is built up and also about farm buildings. Arrive about May 16, depart as soon as the young can fly well, usually the first week in August (Nash, in MSS.).

212. *Chelidon erythrogaster*. Barn Swallow.

Very rare summer resident, Mouse River and various other points along the line (Coues). Winnipeg: Accidental visitant; rare (Hine). Portage la Prairie: Doubtful (Nash). Carberry: Rare spring visitant; arrived May 11, 1882, and May 4, 1884 (Thompson). Shell River, 1885: First seen, four, on May 30; transient visitants only; not breeding (Calcutt). Qu' Appelle: Summer resident; breeds; arrives about May 20 (Guernsey).

I recollect seeing a flock of swallows that tenanted a certain barn in Ontario leave en masse during a heavy thunder storm, and perch on a bare tree in the drenching rain, I suppose, for the sake of the bath. Has this any connection with the notion that swallow-tenanted barns are safe from lightning? The withdrawal of the swallows during the storm when some barn has been struck may have, by an ancient and honorable process of logic, given rise to the idea that the circumstances were cause and effect.

This bird does not occur near Portage la Prairie or Winnipeg. I once thought I saw one at the former place skim past my boat, but as the morning was very misty and I never saw another, I may be mistaken. (Nash, in MSS.)

213. *Tachycineta bicolor*. Tree Swallow. White-breasted Swallow.

Common summer resident of wooded regions; at Pembina breeding in small numbers (Coues). Winnipeg: Summer resident; abundant

(Hine). Oak Point, 1884: Arrived May 3, 1885; first seen, one, on April 28; next seen on May 6; is common and breeds here (Small). Portage la Prairie: Common summer resident in 1884; first seen April 27; arrives about April 20; departs early in August (Nash). Common along rivers in the Northwest, nesting in old hollow trees at Grand Valley (Macoun). Carberry: Common summer resident; breeding (Thompson). Qu'Appelle: Summer resident; breeds; arrives about May 10 (Guernsey).

On July 17, went to the White Horse Hill. Found a large colony of White-breasted Swallows nesting in the old Woodpeckers' holes, with which the timber is riddled, on the margin of the lake that lies north and east of the hill. This is the largest colony I have seen. It numbers, perhaps, twenty pairs. Nearly all of these settlements that I have noted have been close to a sheet of water. However, they are usually to be found wherever the timber is large enough to be hollow, and scarce enough to cast no gloom about the chosen district.

214. *Clivicola riparia*. Bank Swallow. Sand Martin.

Somewhat common summer resident; local in distribution. Pembina: Breeding in colonies, and along the line to the Rockies (Cones). Winnipeg: Summer resident; abundant (Hine). Portage la Prairie: Tolerably common; summer resident; arrive about May 22; depart about August 23 (Nash). Very abundant in the Northwest (Macoun). Portage la Prairie; Assiniboine, near Souris' Mouth; Yellowquills' Ferry (Thompson). Shell River, 1885: First seen, seventeen, on April 30; afterwards seen every day; is common all summer, and breeds here (Calcutt). Qu'Appelle: Summer resident; breeds; arrives about May 10 (Guernsey).

Shash y win e peshou (Martin). It resorts hither in the beginning of June; harbors about the steep banks of rivers, where it breeds in holes, making a slight nest of straw and feathers, and lays five white eggs. It is the latest breeder of the Hudson's Bay feathered tribes. I have repeatedly found new-laid eggs in the latter end of July, and by the middle of August not one of the Swallow species is to be seen. A few days before their disappearance they collect in numbers to particular ponds near Severn Settlement, and fly about along the surface of the water.

I have interrogated the natives who reside here, also those inland, concerning the Swallow being found torpid under water, but to no purpose; indeed, they laugh at my question. I agree with the learned Dr. Forster that Swallows may be under water unknown to the natives, as they don't examine under the ice in the winter; they, for the most part, angle for fish. (Hutchin's MSS., Observations on Hudson's Bay, 1782.)

These birds do not breed in colonies here, but excavate their holes in the bank of the Assiniboine River, singly, and some distance apart. They are late in nesting. On the 21st of July I took out a nest. It was quite new, but contained no eggs. I saw the old birds going in and out of the hole the day before, and just previous to my examining it. (Nash, in MSS.)

215. *Ampelis garrulus*. Bohemian Wax-wing.

Winnipeg: Winter visitant; tolerably common (Hine). I have seen these birds in this country in the month of April only (Hunter). Port-

age la Prairie: Regular but not a common winter visitor here; usually in April (Nash). Carberry: Winter visitant once noted (Thompson).

On November 23, 1886, saw a flock of about twenty Bohemian Chatterers, the only ones I have seen in the country. By a marvellous chance, I brought down one with the rifle without seriously injuring it, as the ball simply broke its back.

216. *Ampelis cedrorum*. Cedar Wax-wing. Cherry Bird.

Common summer resident of woodlands; Mouse River, near the Boundary (Cous). Winnipeg: Summer resident; abundant (Hine). Red River settlement (Blakiston). As far north as Lake Winnipeg (Ridgway). May 31, on an island on Winnipeg River, saw a large flock of fifty or more (Kennicott). Pennawa River (Hind., September, 1857). Ossowa: Common breeding; 1885, first seen one on May 15; next seen May 17; became common on May 19 (Wagner). Oak Point: 1884, arrived May 5; scarce (Small). Portage la Prairie: Abundant summer resident; in 1884, first seen June 2; arrives June 1, departs early in September (Nash). Abundant Manitoba (Macoun). Carberry: Tolerably common summer resident; Duck Mountain. Portage la Prairie (Thompson). Shell River: 1885, first seen five on June 5; is common all summer and breeds here (Calcutt). Qu'Appelle: Common; arrives May 22 (Guerusey).

On July 22, 1884, at Portage la Prairie, found the nest of a Cedar-bird in the woods near the river. It was placed on the branch of a low oak, and was much the same as specimen taken in the eastern provinces. It contained two fresh eggs, from which I infer that the species is a very late nester here. I do not think it arrives early enough in the season to raise two broods.

Its favorite haunts are the tops of the trees along the river banks, and from these it may be seen to launch out into the air every few seconds to capture some passing insect, returning to the perch each time to devour the dainty morsel.

This bird is a most expert fly catcher, hawking about over the rivers after a species of *Ephemera* that appears in July. When engaged in this pursuit they will remain on the wing for half an hour or more at a time, hovering and working to and fro over a space of 100 yards of water. Generally a good many of the birds are in the air at the same time, when the sight is a very pretty one (Nash in MSS).

217. *Lanius borealis*. Northern Shrike.

Tolerably common spring and fall visitant. Dufferin: Arrived before April 15 (Dawson). Winnipeg: Tolerably common (Hine). Portage la Prairie: Regular spring and fall migrant; in 1884, first seen April 11; heard of it two weeks before; arriving about April 10, remaining a short time, and returning about October 1; departing at the end of the month (Nash). Carberry: Tolerably common spring and fall visitant (Thompson). Arrives at Carberry April 7 (W. G. A.

Brodie). Shell River: 1885, first seen, one male, on March 14 (Calcutt). Touchwood Hills (Macoun). Between Hudson's Bay and Lake Winnipeg (on the Nelson River), September 17, 1857 (Blakiston). Trout Lake Station (Murray).

April 5, 1882: Snow 3 to 4 feet deep everywhere. In the woods to the east shot a splendid Northern Shrike. The vermiculations on its breast were almost obliterated. This was left on the roof of the shanty until I had time to skin it. While at dinner we observed another Shrike tearing at a bird on the snow, some yards away. On shooting it I found it was also a *borealis*; its breast fully pencilled; and the bird it was devouring was the other Shrike, which it had carried from the roof.

On October 23 a Shrike came careering around the stacks after an unfortunate Sparrow, which speedily took shelter under the litter. The Shrike hovered over it like a Kestrel, and then swooped. I now entered on the scene, and fired, but missed him. He, however, left the sparrow and dashed off with such an aristocratic air and graceful action that I almost felt I had been engaged in a very small piece of business in thus interfering in the private affairs of a gentleman.

Wa Paw Wisky John, or Great Ash-colored Butcher Bird of Pennant. This bird harbors at all seasons in the year a little distance inland and makes a shrieking noise. In April it builds a round nest of grass, straw, and feathers, neatly interwoven half way up a juniper or pine tree, and lays four light-blue colored eggs. Time of incubation, 15 days. (Hutchins' MSS.; Observations on Hudson Bay, 1782.)

218. *Lanius ludovicianus excubitorides*. White-rumped Shrike. Common Shrike.

Common summer resident of half-wooded districts; common breeding; Pembina and Turtle Mountain (Coues). Winnipeg: Summer resident; tolerably common (Hine). Shoal Lake May 15 and 20, 1887 (Christy). Carberry: Common summer resident; breeding (Thompson). Shell River: First seen, one male, March 14; next seen, one female, summer resident; breeds near my station (Calcutt). Qu'Appelle: Common; breeds (Guernsey).

On May 22, 1884, on a barb of the wire fence, I found a brown cricket firmly impaled. It was evidently not an accident, but the work of a Shrike, for as crickets are found only in August, this must have been in its present position for eight months.

On May 25, found a large yellow burying beetle (*Necrophagus*) impaled on a barb of a wire fence, no doubt by a Shrike.

On July 6, went with Gordon Wright and Miller Christy to the Big Slough on Pine Creek to see a spring that issues from a bed of petrified moss. Found two nests of the Common Shrike, the young of both broods being fledged and able to fly.

In November saw a number of grasshoppers impaled on the barbs of the wire fence, evidently this had been the work of Shrikes.

At least one species of Shrike is common and breeds, building its nest largely of the stalks of a species of *Gnaphalium* in the branches of the low, scrubby oaks that cover the sand-hills (Christy).

219. *Vireo olivaceus*. Red-eyed Vireo.

Abundant summer resident of woodlands: Abundant at Pembina, breeding (Coues). Northwest to Lake Winnipeg (Brewer). Winnipeg: Summer resident, tolerably common (Hine). Portage la Prairie: Common summer resident (Nash). Carberry: Abundant summer resident in woodlands, breeds (Thompson). Very abundant about Lake Manitoba, breeding (Macoun). Cumberland House, June 2, 1827 (Richardson).

On August 29, 1882, C. T. caught a Red-eyed Vireo down by the Slough. It was hurt in the wing, at least it seemed incapable of flight. It fought fiercely, biting at the fingers and snapping like an owl. When I laid it down, it threw itself on its back and fought like a hawk; on holding my finger towards it, it seized hold with its foot and allowed itself to be carried so. It seemed to have an insatiable appetite. It will eat as many dragon flies of the largest kind and as fast as we can catch them for it, and they are far from being a rare insect; six of the smaller kind it swallowed whole in rapid succession, the larger ones he holds to the perch with his foot, and breaks them up before swallowing. One of the latter was given to him alive and caused him some trouble; they had quite a struggle on the floor of the cage before he mastered it, for the dragon fly was nearly as long as himself.

August 31. The Vireo readily eats raw meat. His dietary to-day, includes three dozen house-flies, the entrails of a sparrow, six dragon flies, a couple of large grasshoppers, a couple of crickets, and the greater part of another sparrow.

September 1. Each day the Vireo disgorges a pellet of the indigestible part of its food. This is globular and about one quarter of an inch in diameter. This morning he devoured the entrails of a bobolink, a few crickets, and a number of naked caterpillars; the latter he readily eats, but he refuses to touch the hairy ones.

September 3. The Vireo is dead, it proved a male; length, $5\frac{7}{8}$; extent, $9\frac{1}{4}$. An examination showed clearly that in spite of the enormous meals it had daily made, it had died of starvation. The stomach was quite empty, the fat everywhere totally absorbed, and the breastbone nearly cutting the skin. From this we may form an idea of the enormous quantity of insect food gathered by this bird when at liberty and providing for its young as well as itself.

July 17, 1883. To-day the nest of a Red-eyed Vireo found June 27, contained one young one ready to fly, another but half grown, and an egg which was near being hatched. The nest was composed outwardly of wasp-nest paper. As usual with this species, the old birds did not appear to be much concerned about me. They hopped quietly about

the branches over my head, and evidently kept an eye on me, but to a careless glance they might appear to be merely climbing about in search of their prey.

It is difficult to describe the song of this species so that it will be recognized; but once heard it will be remembered, for no other bird keeps up such an incessant utterance of disconnected bars. During the whole of his serenade the Red-eye will sit motionless and fearlessly among the leaves within a few feet of one's head, and so often have my most earnest efforts to sight the valuable songster been frustrated under these circumstances that I begin to understand how the fable of the singing leaves may have originated.

220. *Vireo philadelphicus*. Philadelphia Vireo.

Summer resident of thickets. Summer resident; it undoubtedly breeds about Pembina (Coues). Winnipeg: Summer resident tolerably common (Hine). Shoal Lake; May 20, 1887 (Christy). West Slope of Duck Mountain breeding, nest found (Thompson).

On June 9, 1884, near Fort Pelly, on the upper Assiniboine I found a Vireo nesting in a small bluff of poplar and willow. The chosen site was in the twigs of a willow some 10 feet from the ground; the nest was the usual suspended cup formed of fine grass and strips of birch bark. On the ground immediately below it was another nest of precisely the same make and materials: intending to take this with me on my return I hung it in the tree, but when I came back I found it on the ground, it was again hung as before, and again thrown down, although it had been firmly attached to a twig. This happened several times so that there was little doubt that it was the Vireo's doing, but why? I can not imagine.

On June 13, the Vireo began to sit on her four eggs. I shot her and found her to correspond exactly with Coues' description of *philadelphicus*, except that the yellow on the breast was quite bright. The eggs closely resembled those of the Red-eyed Vireo, but were destroyed by an unfortunate accident before they were accurately measured. In its habits the bird exhibited the strange mixture of shyness and fearlessness, common to the family; she would continue on her nest while I watched her at a little distance, and when alarmed would quietly hop on a twig and then disappear in the foliage without uttering a complaint.

221. *Vireo gilvus*. Warbling Vireo.

Summer resident of woodlands; in abundance at Pembina (Coues). Winnipeg: Summer resident; tolerably common (Hine). Selkirk Settlements (Brower). Portage la Prairie: Common summer resident (Nash). Carberry: Common summer resident; south slope of Riding Mountain, west side of Duck Mountain (Thompson).

222. *Vireo flavifrons*. Yellow-throated Vireo.

Rare summer resident. Winnipeg: Rare; accidental visitor (Hine). July 18, 1884, Miller Christy brought me specimen of Yellow-throated Vireo from Moosejaw (Thompson).

223. *Vireo solitarius*. Blue-headed Vireo.

Rare summer resident; one secured at Pembina June 4 (Coues). Winnipeg: Rare (Hine). Long River: Duck Mountain; apparently breeding (Thompson).

On June 10, 1884, at Duck Mountain, a solitary Vireo was observed. It was uttering a note like *peechoeee*, somewhat like the call of a Goldfinch or a Linnet.

224. *Mniotilta varia*. Black-and-White Warbler or Creeper.

Pembina: June; probably breeds (Coues). Red River Valley: Summer resident; common (Hunter). Winnipeg: Summer resident; tolerably common; breeding (Hine). Portage la Prairie: Rare summer resident; arrives about May 15, departs in August (Nash). Waterhen: River. Probably breeding; June 24, 1881 (Macoun). Rare at Cumberland House (Richardson). Carberry: Common in migration. Duck Mountain: Common; breeding (Thompson).

June 10, 1884, Duck Mountain: The Black-and-White Creeper is an abundant species in the spruce woods here; its note is a thin twitter, like a Cedar-bird in a hurry; it may be suggested by the syllables, "*Chipili, chipiti, chipiti, chipiti*," uttered faster and faster till it becomes a mere twitter.

225. *Helminthophila ruficapilla*. Nashville Warbler.

Rather rare; summer resident of woodlands. Winnipeg: Summer resident; rare (Hine). Duck Mountain: Breeding (Thompson). Cumberland House: Male, May 15, 1827 (Richardson).

On June 11, 1884, at Duck Mountain, I found the Nashville Warbler in full song and evidently breeding. Its warble is something like that of the Summer Warbler, and may be rendered, "*Toit toit toit toit chip-it-e-chip-it-e ipitiipitipitipiti*," the last part being a continuous twitter.

226. *Helminthophila celata*. Orange-crowned Warbler.

Common summer resident in woodland. Mouse River: Abundant at the boundary in September (Coues). Winnipeg: Summer resident; rare (Hine). Carberry: Common summer resident; breeding (Thompson).

On May 12, 1883, shot an Orange crowned Warbler. It was flitting about with great activity among the poplar catkins, and, from time to time, uttering a loud song like "*chip-e chip-e chip-e chip-e chip-e*."

On May 14 I shot another Orange-crowned Warbler. Its song is much like that of the Chipping Sparrow, but more musical and in a higher key.

The bird is extremely restless and lively, moving about continually among the topmost twigs of the trees and uttering its little ditty about once in every half minute. I have noticed it in all the wooded sections near Carberry, and am disposed to believe that it breeds here.

227. *Helminthophila peregrina*. Tennessee Warbler.

Rare summer resident. Pembina: Common; migrating early in June (Cones). Winnipeg: Summer resident; abundant (Hine). Northern shore of Lake Winnipeg, June 6 (Kinnecott). Duck Mountains. Tolerably common; breeding. Carberry: Fall (Thompson). Cumberland House, May 28, 1827 (Richardson).

June 11, 1884, Duck Mountain: Tennessee Warbler is somewhat common. It usually frequents the heavy timber, and, in its activity and general habits, it presents the same features as the rest of the family. Its song begins with a note like *chipiti, chipiti*, repeated a dozen or more times, with increasing rapidity, then suddenly changed into a mere twitter.

June 12, Duck Mountain. Collected Tennessee Warbler; apparently breeding.

228. *Dendroica tigrina*. Cape May Warbler.

Common summer resident. Winnipeg: Summer resident; abundant along the river (Hine). North to Lake Winnipeg (Ridgway). Shoal Lake, May 16, 1887 (Christy).

229. *Dendroica æstiva*. Yellow Warbler. Spider Bird. Willow Warbler. Willow Wren.

Very abundant summer resident in thickets everywhere. Abundant, Pembina and Mouse River at the boundary (Cones). Winnipeg: Abundant; breeding (Hine). Shoal Lake, March 16, 1887; common (Christy). Ossowa: Common; breeding; 1885, first seen, one on May 18; next seen, May 19; became common, May 20 (Wagner). Oak Point, 1884: Arrived, May 26, 1885; first seen, one on May 16; next seen on May 23; is common and breeds here (Small). Portage la Prairie: Common summer resident; breeding; arrives about May 16; departs early in August (Nash). Common; breeding throughout the Winnepigosis region; the common species of Poplar brush. Lake Manitoba, June 15 to 20; Waterhen River, June 23 (Maconn). Shell River, 1885; first seen, three on May 15; afterwards seen every day; is common all summer, and breeds here (Calcutt). Qu'Appelle: Common summer resident (Guernsey). Carberry: Abundant summer resident. Breeding also in all wooded localities from Carberry to Fort Ellice (Thompson). Trout Lake Station: Severy House; known throughout the whole of the fur countries (Murray).

June 3, 1884, Rapid City Trail: The numerous groves along the

trail here are vocal with the merry warble of the Yellow Warbler. It is one of the commonest birds of the district, and is to be found in all the poplar and dry willow clumps. A specimen collected was a male in full song and very rich plumage, in its stomach was a mass of various insects.

September 8th: Yellow Warblers are singing and going southward.

230. *Dendroica coronata*. Myrtle Warbler.

Abundant migrant; a few breed here; abundant in September; along Mouse River at the Boundary (Coues). Dufferin: Arrived between April 20 and 25 (Dawson). Winnipeg: Summer resident; abundant north (Hine). Shoal Lake May 18, 1887 (Christy). Portage la Prairie: The most abundant Warbler we have, in spring and autumn, arrives about May 1, re-appears in August and departs about the end of September (Nash). Lake Manitoba, June (Macoun). Carberry: very abundant migrant; Souris River; Turtle Mountain; Portage la Prairie; breeding, common on Duck Mountain (Thompson). Shell River, 1885, first seen, nineteen, on April 30; afterwards seen every day in migration; a transient visitor, only passing north and not breeding (Calcutt). Cumberland, May 28, 1827; House (Richardson).

May 5, 1884: Flocks of male Myrtle birds have made their appearance. The bare branches of the yet leafless trees are enlivened by them everywhere, as they flit about in pursuit of the myriad insects, they look like small Flycatchers and the partial illusion is increased by the oft-repeated note, which is much like that of *Empidonax minimus*.

On June 10, Duck Mountain, shot a male Myrtle bird. The species evidently breeds here, its song is frequently heard in the spruce woods, it partakes of the same general character as that of other Warblers. It resembles the syllables, "*pheo pheo pheo pheo pheo pheo pheo, pheu pheo, pheu pheu, pheu pheu, pheu pheu, pheu pheu, pheu pheu.*" The first part being uttered very rapidly, and the last with more deliberation.

September 12, Portage la Prairie: The town to-day is fairly flooded with Warblers in autumnal plumage, passing southward. Yellow-rumps constitute a very large proportion of the host that is making the return journey. Their ranks are now swelled by great numbers of the young, whose liveries are so various and often so very un-yellow-rump-like, that they may cause the beginner no little perplexity.

231. *Dendroica maculosa*. Magnolia Warbler.

Rare; migrant. Winnipeg: Summer resident; common (Hine). Found at Duck Bay, Lake Winnipegosis (Macoun). This is a common bird on the banks of the Saskatchewan: Cumberland House, May 26, 1827 (Richardson). Carberry: I observed a small flock, and secured a single specimen in young plumage, August 24, 1884 (Thompson).

232. *Dendroica pensylvanica*. Chestnut-sided Warbler.

Common summer resident in woodlands. Pembina: One female specimen, June (Coues). Winnipeg: Summer resident; abundant (Hine). Portage la Prairie: Tolerably common summer resident; arrives about May 30, departs in August (Nash). Lake of the Woods: May 29 (B. Ross). Carberry: Abundant in migration; commonly breeding; Duck Mountain, commonly breeding (Thompson). In Minnesota rather rare; breeds (Trippe).

On June 21, 1883, while at the spruce bush collecting, I heard the loud song of what proved to be the Chestnut-sided Warbler from a certain grove of tall poplars. The specimen collected was a male; length, 5; stomach full of small insects; evidently it was breeding. It is a true Warbler, being seen and heard continually among the trees. Its choice of locality usually causes it to be found chiefly in half-open woods, especially along the edges of low, marshy places. While singing I have always observed that it kept among the branches of the taller trees. Its song is somewhat like that of the Orange-crowned Warbler. I can recall it to mind by the aid of the syllables "*Chip-e, chip-e, chip-e, chip-e, chip-e, wai chip*," the single emphatic syllable near the end being the most tangible difference.

June 10, Duck Mountain: The Chestnut-sided Warbler is quite common in this wooded region, and is, no doubt, breeding here. It frequents the tops of the highest trees, and from time to time utters, with little variation, the already described song.

233. *Dendroica castanea*. Bay-breasted Warbler.

Rare; summer resident. Winnipeg: Summer resident; rare; found along the river (Hine). North to Hudson Bay (Ridgway). Portage la Prairie: Rather uncommon; summer resident; arrives about May 30 (Nash).

234. *Dendroica striata*. Blackpoll Warbler.

Rare; migrant; probably breeding. Winnipeg: Summer resident; tolerably common; probably breeding (Hine). Carberry: Rare; spring migrant; noted once only (Thompson). Cumberland House: May 25, 1827 (Richardson). Trout Lake (Murray).

235. *Dendroica blackburniæ*. Blackburnian Warbler.

Rare; summer resident. Winnipeg: Summer resident; tolerably common as far north as Big Island, Lake Winnipeg (Hine). Swan Lake and Porcupine Mountain: Probably breeding (Macoun). Carberry; June 3, 1883, saw a male Blackburnian Warbler to-day, the only one I have observed in the country (Thompson). "*Sylvicola parus*," Severn House: Trout Lake Station (Murray).

236. *Dendroica vigorsii*. Pine Warbler.

Rare summer resident of the wooded country to the north and east. Winnipeg, Common (Hine). Tolerably common in eastern part of the province, where they appear about the end of May (R. H. Hunter). Duck Bay, Lake Winnipegosis, latter part of June (Macoun).

237. *Dendroica palmarum*. Palm Warbler. Redpoll Warbler.

Abundant migrant, on the prairies as well as in woods. Red River settlement (Brewer). Winnipeg: Abundant in migration (Hine). Carberry: Abundant migrant on the prairie, chiefly in spring, Portage la Prairie (Thompson). I saw only one individual at Cumberland House, May 26, 1827 (Richardson). Minnesota: Goes further north to breed (Trippe).

On May 14, 1883, I saw great numbers of Redpoll Warblers. They were in the bushes and also straggling all over the prairie; far from timber and not exactly in flocks. They are noisy, restless birds, and, as many observers have remarked, they are largely terrestrial, and have many of the habits of the Pipits. I collected three specimens.

It passes through this neighborhood and during the summer has not been seen. Yet from the facts that it is exceedingly common here and rare at Cumberland House one might almost infer that it breeds in the Duck and Porcupine Mountains.

238. *Seiurus aurocapillus*. Ovenbird.

Common summer resident of woodlands. Winnipeg: Summer resident; abundant (Hine). Breeding near English River, July 15 (Kennicott). Red River Valley: Summer resident; tolerably common (Hunter). Portage la Prairie: Tolerably common summer resident; arrives in May, departs in September (Nash). Abundant around Lake Manitoba; doubtless breeding (Macoun). Carberry: Tolerably common summer resident; breeding (Thompson). Cumberland House, June 2, 1827; breeds (Richardson).

In Manitoba my opportunities of observing this bird were very few, but since then, while resident in Ontario, I have been most advantageously situated for cultivating its acquaintance. I have in particular become very familiar with the famous air-song, so long a puzzle to the naturalists, that it utters in the evening while floating in the air above the tops of the forest trees. This song may be heard daily during the nesting season by those who know when and where to seek for it, and, so far from being unusual, it will be heard more often, even, than the ordinary "teacher" refrain, which seems to be but little more than a call note. One of the most interesting facts about this lark-like song is that it may be heard at almost any hour of the night in the grove where a pair of these birds have settled for the love season.

239. *Seiurus noveboracensis*. Water-thrush or Wagtail.

Summer resident along water-courses. Winnipeg: Summer resident; abundant (Hine). Red River Valley: Summer resident; tolerably common (Hunter). Around the lakes of the Northwest Territory (Macoun). Carberry: August, 1884 (Thompson). Severn House (Mur-ray).

On August 9, 1884, at Humphreys Lake, I found the Water-wagtail very numerous for the first time, so that evidently the species is migrating. They were to be seen all along the margin skipping about over the floating rushes and bladderwort (*utricularia*), bobbing their tails and uttering their "*chit chit*" in a tone very like that of a Myrtlebird or Least Flycatcher. They are, however, even more noisy when in the trees. One specimen which I shot seemed as much annoyed by my intrusion as though it had a nest close at hand; this one was 6 inches long; stomach full of small insects.

240. *Geothlypis agilis*. Connecticut Warbler.

Somewhat common summer resident of tamarac swamps. Winnipeg: Rare (Hine). Carberry: Tolerably common; summer resident; nest found June 21, 1883. Duck Mountain: Tolerably common; probably breeding (Thompson).

On June 21, 1883, I found the nest and eggs of the Connecticut Warbler. On June 29, in the spruce bush, I shot a Connecticut Warbler, a male; length, 6 inches; stomach filled with insects; it haunted the tops of the low tamaracs and sang a song like "*Beecher-beecher-beecher-beecher.*"

June 14, 1884, Duck Mountain: One or two pairs of Connecticut Warblers are breeding in the tamarac swamp near here. Besides the song already recorded I have noted another type; it nearly resembled the syllables "*Fru-chapple fru-chapple fru-chapple whoit,*" and is uttered in a loud, ringing voice, quite unlike the weak, hurried lisping of the Wood Warblers, which are nesting abundantly in the adjoining dry spruce woods.

The life history of this graceful species has so long continued involved in obscurity that it is with exceptional pleasure I find myself enabled to cast light upon several of the most important of its habits. I had the good luck to find its nest, the first of the kind known to science. (This was subsequently sent with the bird to the Smithsonian Institution, where the identification was confirmed and the nest finally deposited.) The find was announced in the "*Auk*" (April, 1884, p. 192). I reproduce the article:

A few miles south of Carberry is a large spruce bush, and in the middle of it a wide tamarac swamp. This latter is a gray mossy bog, luxuriant only with pitcher plants and droseræ. Over its surface at regular intervals, as though planted by the hand of man, grow the slim, straight tamaracs, grizzled with moss, but not dense nor at all

crowded; their light leafage casts almost no shade, so that they always look as though just about to end, though the swamp really continues for miles the same dark-gray waste. I had often visited the bog when on exploring expeditions in the neighborhood, but seldom found any bird-life of special interest. On the day mentioned, while out collecting, I had braved the mosquitoes and traversed the bog for some distance, when beside the whistling croaks of the great crested and olive-sided Flycatchers, usually the only bird voices of the place, my ear caught the clear song of a Warbler. It may be suggested by the syllables "*bee-cher-bee-cher bee-cher-bee-cher bee-cher-bee-cher*." It was somewhat like the song of the Oven-bird, but different in being of the same pitch throughout instead of beginning in a whisper and increasing the emphasis and strength with each pair of notes to the last. Guided by the sound I found the bird high up in a tamarac. It was much less shy than the Wood Warblers, so that it was easily secured. It proved to be a male Connecticut Warbler.

As I went on a small bird sprang suddenly from one of the grave-like moss-mounds by my feet. It seemed distressed and ran along with its wings held up like a Plover just alighting. On seeing that I would not be decoyed away it returned and ran around me in the same attitude. Recognizing it as the Connecticut Warbler I stifled all feelings of pity, added the bird to my bag, and then sought out the nest in the moss. It was composed entirely of fine grass and sunken in the ground as already described. The eggs, four in number, measured .75 by .56 inch. Before being blown they were of a delicate creamy white, with a few spots of lilac, purple, brown, and black inclined to form a wreath about the large end. The creamy white ground color was replaced by white after the blowing process. The female was as follows; Length, 5 $\frac{3}{4}$; stomach full, many coleoptera and one caterpillar; but little ash on head. Male, length, 6; head and breast clear ash, without brownish tints.

241. *Geothlypis philadelphia*. Mourning Warbler.

Common summer resident of dry scrub lands; breeding abundantly at Pembina (Cones). Winnipeg: Summer resident; abundant (Hine). Selkirk Settlement (D. Gunn). Very abundant at Waterhen River and Swan Lake; nest taken June 28, 1881, in a low bush of *Corylus rostrata*, about 4 feet from the ground (Macoun). Carberry: Common summer resident in the wooded thicket about the spruce bush; Duck Mountain (Thompson).

On June 22, 1883, while at the spruce bush, I shot a couple of Mourning Warblers. It is quite common here. I usually found this merriest of mourner frequenting dense, scrubby undergrowths on dry land, a choice of locality, which contrasts greatly with that of its near kinsman, the Maryland Yellowthroat. It is a very difficult bird to get sight of by following it. On one occasion I had been creeping and crawling about in a thicket for over an hour in a vain attempt to secure one of the many Mourning Warblers that were uttering their loud "*woichy woichy woichy woichy woi cha cha*." Although I was often within 20 feet of a specimen I failed to obtain sight of a single one, until, at last, tired of this hide and seek game, I sat down on a log, resolving that if they would not wait for me to come to them, I would sit and wait for them to come to me. I then sat perfectly still for a few minutes. The simple warble was defiantly sounded in a near thicket a few times; then, as I did not move, the little bird suddenly flitted up to a higher post of observation within my view, and presently I put it in my basket.

242. *Geothlypis trichas*. Maryland Yellowthroat.

Common summer resident of damp thickets; Pembina and Turtle Mountains (Coues). Winnipeg: Summer resident; abundant (Hine). Shoal Lake: May 23, 1887, several seen, but not in a flock (Christy). Oak Point: 1884, arrived May 26 (Small). Portage la Prairie: Abundant; summer resident (Nash). At Waterhen River: Breeding; nest not on ground, but elevated a foot or two on the land, subject to floods (Macoun). Carberry: Common summer resident; Duck Mountain; abundant; breeding (Thompson).

On June 28, 1883, shot a Maryland Yellowthroat. Its song was like "*Rap-pittity rap-pittity, rap-pittity rap.*" The species is very abundant in the alder thickets along by the small lakes and ponds.

June 8, 1884, Duck Mountain: The Maryland Yellowthroat is an abundant species about here. Its favorite haunts are low, damp thickets, so that it is, in a measure, the complimentary species of the Mourning Warbler, which manifests a liking for none but the driest of copses.

Like the Mourning Warbler, also, it seems to take a mischievous delight in playing "Jack o' Lantern" to the collector, for it will lead one for hours through a maze of dank alders and water-willows, pausing, now and then, to encourage its distressed, mud-splashed, bramble-scratched follower, by calling loudly and plainly "*What a pity, what a pity, what a pity, pit,*" or again, when the persevering one has happened on some new accident, it announces its whereabouts in notes, which, by a slight stretch of the imagination, may be rendered "*What's the matter, what's the matter, what's the matter, mat.*" Often as has happened with myself the ardent collector will, at length, find that, after all his trouble, this black-masked "Will o' the wisp" has quietly left the neighborhood when it found the plot thickening too much for its amusement, and yet, all this time, perhaps, it has never once exposed itself to the eyes of the gunner.

To-day, while watching one of this species, I was surprised to see it suddenly spring up about 10 feet in the air, where, hanging poised, with its legs and tail dangling down, it uttered a prolonged and musical chant that lasted for nearly half a minute, then dived into the willows to take up the "*what-a-pity*" notes where it left off. But for the place, (the Upper Assiniboine,) and the plain view I had of the diminutive bird, I should have been sure that it was the Yellow-breasted Chat that had performed for my benefit, so nearly did the actions and voice of the Yellowthroat resemble those accredited to the droll *Icteria*. This song partook of the continuous and voluble character common to all air-songs, and due, it is supposed, to the vigorous motion of the wings reacting on the pneumatic system of the bird.

243. *Sylvania pusilla*. Wilson's Warbler. Black Capped Flycatcher.

Not common, chiefly as a migrant. Winnipeg: Summer resident; somewhat plentiful in spring and fall (Hine). Near Long River, May 21, 1882, saw a Black Capped Warbler (Thompson.)

244. *Sylvania canadensis*. Canadian Warbler.

Summer resident of wooded hillsides; north to Lake Winnipeg (Ridgway). At the head of Lake Winnipegosis, middle of July, 1881; not common; probably breeding (Macoun). Carberry: Rare; spring migrant (Thompson). Cumberland House: Male, June 6, 1827; from the time of year in which it was seen, we have no doubt of its breeding in that quarter (Richardson).

On June 3, 1883, I observed a Canadian Warbler in the woods to the eastward. This is my only Manitoban record. I append a note made in Ontario on this species in 1885.

Although this bird is not rare and has a wide breeding range in our own territory, its habits are not at all well known. I usually found it frequenting the bases and northern slopes of thickly wooded hillsides or alder thickets on the adjoining flats. Its song is loud and striking, and may be syllabically rendered "*rup-it che, rup-it-che, rup-it-chitt-it-lit.*" In the springtime it is heard hourly about its chosen localities, but after midsummer it is silent, having, I believe, no fall song period.

245. *Setophaga ruticilla*. American Redstart.

Common summer resident of that woods; very abundant at Pembina; breeds (Coues). Winnipeg: Summer resident; abundant (Hine). Common near Rainy Lake May 26, and near Lake Winnipeg June 6 (Kennicott). Shoal Lake, May 23, 1887 (Christy). Portage la Prairie: Common, chiefly in spring; summer resident; arrives about May 16; departs at the end of September (Nash). Very abundant around Lake Manitoba (Macoun). Carberry: Long River; Duck Mountain; breeding (Thompson). Shell River: 1885, male, first seen, one, on May 24; next seen, five, on June 2; first, female, May 26; next seen, three, on June 2; transient visitant, going north (Calcutt). Cumberland House: Male, May 20, 1827, and June 30, 1830 (Richardson).

June 8, 1884, Duck Mountain: Found the dainty nest and eggs of a yet more dainty Redstart in a low fork of a sapling. The mother bird seemed greatly distressed when she saw me approach her treasure. She flitted close to my head, and ran, beseechingly, on the ground at my feet, and "chipped" most plaintively. But midst all her grief she never ceased to catch flies whenever one of these tender morsels came within reach of her ready bill.

Ne-mis-cù Apethayshish * * * It derives its name from ne-mis-cù (thunder), because its note is heard but seldom except before thunder, which it therefore fore-

tells; plentiful inland in summer, but migrate southward in the winter; but I could not learn any more of its natural history, its not being known to the natives near the Albany Fort, where this specimen was shot. (Hutchins, MSS., observations on Hudson Bay, 1782.)

246. *Anthus pensilvanicus*. American Pipit, or Titlark.

Abundant spring and fall migrant. Winnipeg: Transient visitor; tolerably common (Hine). In considerable numbers along Mouse River in September (Coues). Portage la Prairie: Abundant; autumn visitor; I have not noted it in spring; arrives about September 20, and remains until the end of October (Nash). At Pelly: September 15, 1881 (Macoun). Carberry: Abundant; migrant; Turtle Mountain (Thompson).

October 8, 1884: Pipits are here in much greater numbers than in the spring, and are bustling about in the barnyards and pastures, first attracting notice by their untiring repetitions of the note "*chepit, chepit*." Then, holding the attention by the remarkable habit they have of wagging the tail unceasingly, whether flying, perching, or running on the ground; they seem to be under some awful obligation to keep on wagging, not their tails only, but the whole of the latter end. The motion is absurdly excessive, and the birds look as though they would stop it if they could.

247. *Anthus spragueii*. Sprague's Pipit. Missouri Skylark.

Common summer resident of the elevated prairies of the south and west. Winnipeg: Rare (Hine). From Pembina Mountain westward along the boundary to the second crossing of the Mouse River; breeding in great numbers; Turtle Mountains, Mouse River, etc. (Coues). Carberry: Abundant; summer resident (Thompson).

On May 7, 1883, I noticed the Missouri Skylark, or Sky Jingler as we used to call it.

May 7, 1884: Have at last succeeded in collecting a skylark that I knew to have been singing aloft. It appears to be *Anthus spragueii* (identification subsequently indorsed by Dr. C. Hart Merriam). Male adult: Length, $6\frac{1}{4}$; weight, $3\frac{1}{4}$; tail, $2\frac{1}{4}$; beak, $\frac{3}{8}$; toes, $\frac{7}{8}$; hind toe, $\frac{7}{8}$, of which claw is about half; toes reach beyond the tail; stomach full of coleoptera. It differs from Baird's description as follows: It has vibrissæ, the outer tail feathers not entirely white; the outer toe not quite free; first primary not longest, but second and third are; tail even, not emarginate; legs and bill not yellow, but flesh-colored. It is an extremely shy bird, and for long I confounded it with the shorelark, whose song and habits on the wing are so similar.

On May 10, I counted twelve skylarks singing far up in the sky, during a 3-mile walk in the morning.

May 13. Skylarks very numerous now, and in full song.

On May 14, I watched a skylark that was singing on high with

great devotion; he had trilled his refrain from beginning to end at least twenty times when it occurred to me to time and count his songs. The whole of each trilling occupied 15 seconds, and after I began to count he repeated it from beginning to end eighty-two times; just as he should have entered on the eighty-third, his wings closed, his tail went up, and down he fell headlong; but my eyes were blinded with the brightness, and my neck refused to take part in further proceedings, so that I was not able to mark the bird for closer examination. This singer had serenaded me for about an hour, and I do not think he ranked above his fellows in staying power.

On May 19 collected a skylark that sang its song only twenty times before it dashed down to earth. Saw another singing on the ground; this is the only case of the kind I have observed. It is one of the commonest of prairie birds in western Manitoba. Its loud ventriloqual voice is heard from the clouds on all hands when it is in full song. This song was for long a riddle past my solving. I felt sure of its being the utterance of some bird on the prairie, but where, I could not tell nor trace; wherever I went, it seemed to be just a little further ahead, or to one side or another, or suddenly behind. Throughout the whole season of 1882 I was thus duped, and it was by chance that at last I found the singer to be away up in the sky, but so high that as it was a bright day it was impossible to follow with the eye the tiny speck whose music was shaking the air for thousands of feet around. The song is sweet and far-reaching, and both Audubon (the discoverer) and Dr. Coates (the further elucidator) have given most enthusiastic descriptions of its moving power and melody. When the skylark feels the impulse to sing, he rises from the bare prairie ridge with a peculiar bounding flight, like that of the pipit; up, in silence, higher and higher he goes, up, up, 100, 200, 300, 500 feet; then, feeling his spirits correspondingly elevated, he spreads his wings and tail and pours forth the strains that are making him famous. The song at the beginning is much like that of the English Skylark, and the notes are uttered deliberately but continuously, and soon increase in rapidity and force, till in a few seconds the climax is reached, after which they fade away in a veery-like strain, and then suddenly stop. While this was being sung the bird had floated downwards, and as soon as it is finished he proceeds, by the bounding flight, to regain his elevation and once more pour out his silvery strains.

Several times after a skylark had sung and returned to earth, with the headlong descent already described, I purposely flushed him, and at once he rose without further preamble, soberly remounted his imaginary 500-foot platform, and again sang his serenade from beginning to end. Thus on one occasion I called the same bird three times "before the curtain;" to the fourth *encore*, however, he would not respond, and each subsequent time that he was disturbed he would fly off some 200 yards and again settle on the prairie. Once only have I observed this species singing his full song on the ground.

248. *Galeoscoptes carolinensis*. Catbird.

Abundant summer resident of low thickets. Common in Red River region and westward along the boundary to Turtle Mountains; breeding (Coues). Winnipeg: Summer resident; abundant (Hine). North to Lake Winnipeg (Ridgway). Ossowo: Common; breeding; 1885, first seen, one, on May 26; next seen, May 27 (Wagner). Oak Point: 1884, arrived April 30 (?); 1885, first seen, one, on May 14; next seen, one, on 15th; is common and breeds here (Small). Portage la Prairie: Common; summer resident; arrives about May 22; departs about September 15 (Nash). Carberry: Abundant; summer resident; breeding; all thickets from Carberry to Birtle and north to Dark Mountain abundant; breeding; Long River (Thompson). Two Rivers: 1885, first seen, one, on May 25; next seen, one, on May 26; fairly common (Criddle). Common throughout the wooded country in the Northwest (Macoun). Shell River: 1885, first seen, one, male, on May 18; next seen, four, on May 24; is common all summer and breeds here (Caltutt). Qu'Appelle: Common summer resident; breeds; arrives about May 15 (Guernsey).

On June 22, 1882, I took the four eggs from the catbird nest found June 18; one measured $\frac{1\frac{1}{8}}{1\frac{5}{8}}$ by $\frac{1\frac{5}{8}}{1\frac{5}{8}}$ and is of a deep blue-green; the others are similar. The nest was made entirely of sticks and black fibrous roots, and was placed in the densest part of a willow thicket, thus giving us a pair of sooty birds building in a gloomy thicket a black nest to contain the brightest blue-green eggs that ever were laid!

The month of June, 1884, was spent in traveling with my brother, "per cart," in the country between Carberry and Côté's Reserve, near Fort Pelly. Throughout the whole of this region the catbird is an abundant species, and I had ample opportunities for studying the song of this bird, for it seemed at much pains to render itself the most conspicuous of the feathered population, while at the same time it strove with equal diligence to remain unseen. Each night we slept in some thicket of willows, and each morning we were awakened by an incessant scolding from a vituperative catbird, who continued to skulk about and mew and squeal, until at length the evident miscarriage of his purpose to remain unseen warned him that his wisest course entailed a speedy departure.

249. *Harporhynchus rufus*. Brown Thrasher, or Thrush.

Common summer resident of dry, partly open country. Pembina: Nesting (Coues). Winnipeg: Summer resident; tolerably common (Hine). On the flank of the Big Ridge, the Cinnamon Thrush (*Turdus rufus*) was noticed (Hine). Lake Winnipeg (Ridgway). Red River Valley: Summer resident; tolerably common (Hunter). Oak Point: 1884; arrived May 21 (Small). Tolerably common summer resident

near Portage la Prairie; abundant near Winnipeg; arrives about the middle of May, departs late in September (Nash). On the Portage la Prairie trail, east of Fairview "The Cinnamon Thrush is not uncommon among the sandy hills; we saw several during the day" (Hind, 1858).

Carberry: Common summer resident; breeding; Long River; Shoal Lake, west (Thompson). At Swan River; not common (Macoun). Shell River: 1885, first seen, one male, on May 23; next seen, two, on May 25; is common all summer and breeds here (Calcutt).

250. *Troglodytes aëdon aztecus*. Western House Wren. Common Wren.

Abundant summer resident in partly wood localities. Breeding very abundantly at Pembina in June; taken at Mouse River in September (Coues). Winnipeg: Summer resident; tolerably common (Hine). Os-sowo: Common breeding; 1885, first seen, two, on May 18; next seen, May 19; became common, May 20 (Wagner). Oak Point: 1884, arrived May 17; 1885, first seen, one, on May 17; next seen, one, on May 18; is common and breeds here (Small). Portage la Prairie: Common summer resident; arrives about May 21; departs early in September (Nash). Carberry: Abundant summer resident; breeding; Duck Mountain breeding (Thompson). Manitoba House, June: Breeding; also at Waterhen River; frequent (Macoun). Shell River: 1885, first seen, a pair, on May 17; afterward seen every day; is common all summer, and breeds here (Calcutt). Qu'Appelle: Common summer resident; breeds; arrives May 12 (Guernsey).

On July 9, 1884, I found a nest of young wrens over a window of the ferry house on the Assiniboine. The old ones were laboring so incessantly to furnish them with food that I timed their journeys to ascertain the amount of attention required by the nestlings. The parents returned ten times in fifteen minutes, sometimes bringing only one insect, but usually with their bill full of them. Twice during that time they carried out dung in their bills, dropping it some 20 yards from the nest. At this rate the old ones would make not less than five hundred journeys each day. The time of observation was 6 o'clock in the evening. Mr. Kennicott ascertained that a pair of wrens carried to their young about one thousand insects in a single day; but this is perhaps below the mark, for the pair I have just mentioned often brought three or four insects at a time.

It is probable that two broods each season are raised by this species in Manitoba.

It will be seen that although this bird usually nests in a hollow stump, it is not averse to a different situation, provided only that it be a hole, and deep enough and narrow enough to exclude any but the owner. If the hole chance to be in the least a loose fit, his first care is to blockade the doorway with the largest twigs he can carry until he has reduced it to his own idea of snugness; and I learned to accept it

as the infallible doorplate of a wren's homestead when a bundle of twigs was seen projecting from a cranny in some decrepit-looking stump, a hollow rail, or a knot hole in an outhouse.

On one occasion I was told that a wren had built its nest in the pocket of a coat hung on the door of a ferryman's house on the Souris River. (Christy.)

My records of the nesting of this bird show that it is rather a late breeder here. In 1884 they are as follows: July 19, nest containing young well fledged; July 21, found nest containing young half fledged; August 5, another nest containing young nearly fledged. These nests were all built just under the top of the river bank. (Nash, in MSS.)

251. *Troglodytes hiemalis*. Winter Wren.

Summer resident in the thick woods to the eastward. Is common in the wood country east of Winnipeg during the summer months (R. H. Hunter). Portage la Prairie: Rare visitor; on May 16, 1885, I believe I saw this species in the woods near here; the bird was feeding on the ground, but when it saw me it disappeared in a large pile of old logs and brush, out of which my dogs could not drive it; on October 29, 1886, I identified it on the west bank of the Red River, about 5 miles south of Winnipeg (Nash).

252. *Cistothorus stellaris*. Short-billed Marsh Wren.

Summer resident of erratic distribution found in sloughs. Rather plentiful at Pembina; undoubtedly breeding (Coues). Winnipeg: Summer resident; rare (Hine). Red River Valley: Summer resident; rare (Hunter). Portage la Prairie: Rare; I have only taken it twice, October 3, 1884, near here, and October 7, 1886, about 7 miles south of Winnipeg (Nash). Carberry, south slope of Riding Mountain, north to near Coté's, abundant summer resident of the grassy (not the rushy) sloughs (Thompson). Qu'Appelle: Common summer resident; breeds; arrives May 15 (Guernsey).

Soon after the 1st of May every little sedgy pool and slough in the Assiniboine Valley, from Carberry to Pelly, is vocal with the merry chatter of this bird.

Its ordinary note is like two stones being struck together about a dozen times in succession; the first strokes with a slight pause between those following, with rapidly reduced interval until the last are all run into each other. It may be suggested by the following syllables: "*Chap — chap — chap — chap, chap, chap, chap p-p-p-r-r-r.*"

About the 6th or 7th of May it begins to sing a simple song, which naturally divides itself into three parts or bars: First, the "chappering" already described; second, in close connection a rather musical refrain of equal length, somewhat like the first half of the baywing's sunset song, but without its richness and with less of its power; and third, the "chappering" again from beginning to end. These call notes and songs may be heard on all sides for some time before a single

wren is espied, for they creep and scramble about like mice in the tangled herbage along the sloughs. Many a time I have marked one as it entered a small tussock and then, expecting to flush it, I have gone over and kicked the tussock in vain; the bird had slipped out at the other side, and was probably watching me from behind a rushroot a yard or two removed.

When singing, it is usually seen clinging to the side of some tall swinging reed, with its tail bent back so as to almost touch its head, thus exhibiting in a most exaggerated manner a characteristic attitude of all the wrens.

The nest is a globular structure, and judging by the one or two cases that I have observed is generally placed in a grass tuft. If there is any difference, I think the Short-billed selects a dryer situation for his home than the Long-billed Marsh Wren.

253. *Cistothorus palustris*. Long-billed Marsh Wren.

Summer resident of marshes. Winnipeg: Summer resident; tolerably common (Hine). Have noticed it from Selkirk to the Souris, particularly at Shoal Lake, north of Winnipeg, where they appear to be very common (Hunter). Oak Point: 1884, arrived May 15 (Small). Portage la Prairie: 1884, common summer resident (Nash). Abundant; breeding; at Winnipeg; at Waterhen River (Macoun). Never found at Carberry, or in any part of the Upper Assiniboine, so far as I know (Thompson).

254. *Certhia familiaris americana*. Brown Creeper.

Very rare; summer resident of woodlands. North to Red River Settlement (Ridgway). Winnipeg: Summer resident; rare (Hine).

255. *Sitta carolinensis aculeata*. Slender-billed Nuthatch.

Somewhat rare; summer resident of woodlands; its distribution seems to be much the same as that of the oak (*Q. macrocarpa*). Winnipeg: Summer resident; rare (Hine). Portage la Prairie: Common; chiefly in spring and fall (Nash). Carberry: Summer resident (W. G. A. Brodie). Rare in the spruce bush south of Carberry; seen in fall chiefly; Rat Portage in fall (Thompson). Was not an abundant species, but I brought home one specimen taken at Carberry in summer, 1883 (Christy).

On October 24, 1884, I was guided in the woods to a nuthatch by the sound of his hammering, which was so loud that I attributed it to the Hairy Woodpecker. I watched for a few seconds and found that he was busied "hatching" a hazlenut, which he had fixed in a crevice of the bark. Then I came near, whereupon the bird, fearing I should become troublesome, endeavored to take his nut and go elsewhere, but

it was so firmly fixed in the bark of the tree that I was within a few feet of him before it was extricated, and he flew off with it in his beak.

Common in spring and autumn near Portage la Prairie, appearing in the spring in large flocks about the end of April; in the autumn the broods come straggling back and disappear as soon as cold weather sets in; these are in all probability *S. carolinensis aculeata*.

On the 13th of December, 1884, and from then to the 20th, in the Riding Mountains I saw White-bellied Nuthatches every day; the weather was intensely cold, nearly 40° below zero; these were probably the typical form.

I did not see a single White-bellied Nuthatch of either variety in 1886 near Winnipeg. (Nash, in MSS.)

I can not concur that both forms of *Sitta carolinensis* are found in Manitoba; all that I have seen are nearer to *aculeata* than to the typical subspecies.—(E. E. T.)

256. *Sitta canadensis*. Red-breasted Nuthatch.

Very rare summer resident. Red River Settlement (D. Gunn). North to Lake Winnipeg (Ridgway). Winnipeg: Rare; summer resident (Hine). Portage la Prairie: Rare (Nash). Carberry: Once seen in May? (Thompson). In company with Black-cap Tit and *Regulus* on two occasions on the 26th of September, 1857, not far west of Lake Winnipeg, on the Lower Saskatchewan, a specimen preserved (Blakiston).

Mochic a nak a sish. This bird is a species of the titmouse genus; seldom visits the seacoasts, but are very plenty about 300 miles inland in summer, where it breeds, making an elegant nest in a tree, lays five to ten eggs; feeds on berries and insects from the tree; at the approach of winter it retreats to a more hospitable climate, which is contrary to the other titmouse, who are most numerous about the settlements in a severe cold winter. (Hutchins, MSS., Observations on Hudson's Bay, 1782.)

The first I saw flew into my house at Fort Rouge, near Winnipeg, about the 15th of August, 1886; some few days afterwards I saw one in the woods near the Red River, and on the 1st of September another bird came into my house and amused itself for some time by catching flies about the walls, regardless of the presence of my family. September 23 I saw another in the woods above mentioned, and on the 30th I saw a party of three near the river; of these I shot one, and so tame were they that the others did not fly or show the least alarm at the report of the gun. Shortly after this I saw another single one, the last of the season. None were ever seen by me near Portage la Prairie, or in fact anywhere but in the woods on the Red River, as before mentioned. (Nash, in MSS.)

257. *Parus atricapillus septentrionalis*. Long-tailed Chickadee.

Resident; abundant in wooded sections. The Manitoba bird is not strictly *septentrionalis*, but is nearer to that form than to *atricapillus*. Winnipeg: Resident; tolerably common (Hine). Lake Winnipeg (Kennicott). Winnipeg River: A female, that was about to lay her egg (B. Ross). Ossowa: Common resident (Wagner). Portage la Prairie: Resident, I believe; but although they are abundant during autumn,

winter, and spring, yet they disappear mysteriously during the summer months; I saw them in December, in the Riding Mountains (Nash). Carberry: Common resident in the woods to the south and east: Rat Portage, abundant in fall (Thompson). Very common in Northwest Territory, along our route (Macoun). Shell River: 1885, winter visitor (Calcutt.) Qu'Appelle: Common permanent resident; breeds (Guernsey).

258. *Parus hudsonicus*. Hudsonian Chickadee.

Found only in the north and east among the great coniferous forests. Permanent resident; common in the coniferous woods in the northern and eastern parts of Red River Valley (Hunter). In flocks around the Porcupine Mountains (Macoun). Seen and examined between Hudson Bay and Lake Winnipeg (on the Nelson River); did not find it between Norway House and Fort Carleton after leaving the thickly wooded country to the east of Lake Winnipeg.

259. *Regulus satrapa*. Golden-crowned Kinglet or Wren.

Very rare migrant; probably breeds. Winnipeg: Summer resident; rare; possibly breeding (Hine). Portage la Prairie: Very rare migrant; October, 19, 1886, I saw a flock of about fifteen near the junction of the Assiniboine with the Red River; they were very tame; these are all I ever saw in Manitoba (Nash). Carberry: November 5, 1884. While hunting in the sand hills to the south, to-day, I came across a flock of four Golden-crested Wrens; they were clambering about the tops of some low spruce trees, and uttering their peculiar "*streeep, streeep*;" this was nearly three weeks after the ground was covered with snow; this was the only occasion in which I met with the species in the province (Thompson).

260. *Regulus calendula*. Ruby-crowned Kinglet.

Tolerably common migrant. Mouse River in September (Coues). Dufferin: Arrived between April 15 and 20 (Dawson). Winnipeg: Summer resident; tolerably common (Hine). Portage la Prairie: Common spring and autumn visitor; arrives about April 20, reappears about the middle of September, and departs at the end of the month; the Ruby-crown has a very pretty song; in spring its volume is astonishing, when one considers the little body that produces it (Nash). Carberry: Common in spring migration (Thompson). Occasionally observed (between Norway House and Fort Carleton in autumn); specimens closely examined; gold crest not seen (Blakiston).

On May 12, 1883, while hunting along by the slough, I heard a loud-voiced warbler singing a song like *pie piee pi-ee heep-pi-che heep-pi che heep-pi-che heep-pi-che heep-pi-che heep-pi-che heep-pi-che*. It began very softly, but soon rang out as loud and strong as a Canary. I managed

to shoot one, and was surprised to find it a Ruby-crowned Wren, for the volume of sound would have done credit to a much larger bird.

In its habits, as well as its food, this species closely resembles many of the wood warblers, so that it is difficult of identification when among the branches; but its peculiar nimbleness and its trick of playing and dashing after insects among the topmost twigs, together with its chick-a-dee-like manner of climbing about, will often cause its identity to be suspected, if these ways do not entirely distinguish it from the *Mniotiltidæ*.

261. *Turdus fuscescens*. Wilson's Thrush. Veery.

Abundant summer resident of thickets. Observed only in vicinity of Pembina; breeding in abundance during June (Coues). Red River Valley: Summer resident; tolerably common (Hunter). Selkirk and Red River (Gunn). Shoal Lake: May 20, 1887, seems to arrive on this date (Christy). Oak Point: 1884, arrived May 17; 1885, first seen, one, on May 3; next seen on May 5; is common and breeds here (Small). Portage la Prairie: Abundant summer resident; arrives April 23, departs at the end of September (Nash). Lake Manitoba and westward, nest found on the ground (Macoun). Carberry: Abundant summer resident; breeding; noted in all the willow thickets from Carberry along the south slope of the Riding Mountain, and north to Côté's Reservation (Thompson). Qu'Appelle: Tolerably common summer resident; arrives about May 20 (Guernsey).

On June 18, 1882, I heard again and again, the first time for the season, a song that has been familiar for years. I had always attributed it to a thrush, but now was able to identify the bird more exactly as the Tawny Thrush, or Veery. The song is a high-pitched whistle, yet rich and clear, with a rippling cadence like a little brook. It seems almost profane to represent this soft silvery tinkling by adopting uncouth syllables, yet I think the best idea of the mere articulation may be suggested by the syllables "*Veery, veery, veery, veery,*" from which, no doubt, the singer got his name.

261a. *Turdus fuscescens salicicolus*. Willow Thrush.

Taken on the Souris at the boundary, in the fall migration, September 16, by Dr. Coues. Recorded as *Turdus swainsoni*.

262. *Turdus aliciae*. Gray-cheeked Thrush.

Migrant. Common migrant at Winnipeg (Hine). Migrant at Carberry (Thompson).

263. *Turdus ustulatus swainsoni*. Olive-backed Thrush.

Tolerably common summer resident. I am disposed to question all these records, as this bird is generally confounded with *T. aliciae* (E. E. T). Winnipeg: Summer resident (Hine). Portage la Prairie: Rare;

summer resident; common in spring and autumn; arrives about April 27, re-appearing about September 15; departs early in October (Nash). Swan River and Moose Mountain: Breeding in rose thickets a few feet from the ground and in cornel bushes; eggs spotted (Macoun). Carberry: Summer resident; not very common; apparently breeding; Long River; Duck Mountain? (Thompson). Shell River: 1885, first seen, a pair, on April 30; is common all summer and breeds here (Calcutt).

264. *Turdus aonalaschkæ pallasii*. Hermit Thrush.

Common summer resident of woodlands. Winnipeg: Summer resident; abundant (Hine). I have noticed them at Kildonan, Selkirk, Brandon, and Fort Qu'Appelle; at the latter place they were nesting first week in June (Hunter). Portage la Prairie: Common summer resident; arrives about May 1; departs early in October (Nash). Lake Manitoba and west to Fort Pelly? (Macoun). South slope of Riding Mountain on Little Saskatchewan, August 28, 1858 (Hind). Shell River: First seen, two males, on April 18; a transient visitor, passing north and not remaining any time (Calcutt). Observed at Cumberland House on the 4th of October; I saw it several times, but had no gun (Blakiston).

265. *Merula migratoria*. American Robin.

Common summer resident in half open woods, etc.; breeding. In abundance at Pembina; breeding; in September, large numbers along Mouse River (Coues). Dufferin: Arrived in 1874 between April 15 and 20 (Dawson). Winnipeg: Summer resident; abundant (Hine). Red River Settlement, fourth week of April (Blakiston). Swamp Island: 1885, first seen, about thirty, on April 27, after which it was common, and it breeds here; in fall, last seen October 7; 1886, first seen, ten, on April 18; bulk arrived next day (Plunkett). Ossowa: Common; breeding; 1885, first seen, five, on April 18; next seen, April 20; became common April 25; last seen, one, on October 20 (Wagner). Oak Point: 1884, arrived, April 10; 1885, first seen, two, on April 8; next seen, April 9; afterwards common; breeds (Small). Portage la Prairie: Common; summer resident; arrives in April; my earliest spring record is April 3, 1885, when I saw a small flock; the latest is April 20, the bulk having then arrived; they frequently remain until after snow has fallen, feeding on the wild grapes and high-bush cranberries. The latest date I have is November 3, when I saw a large flock; the ground was then covered with snow (Nash). Abundant everywhere throughout the Northwest (Macoun). Carberry: Very abundant in spring migration; common summer resident; breeding (Thompson). Two Rivers: April 17, 1884; 1885; first seen, several, on April 16; next seen, April 17; became common April 20; is pretty common and breeds here (Criddle). Dalton: 1889, first seen, two, on April 12; became common on April 13; breeds here (Youmans). Braun-

don, April 20, 1882 (Wood). Shell River: 1885, first seen, two, on April 13; next seen, thirteen, on April 17; became common on April 24; male and female in flock; common all summer and breeds here (Calcutt). Qu'Appelle: Common summer resident; flocks of four or five about April 12 (Guernsey). Severn House, Trout Lake Station: The color is unusually bright in the specimens received (Murray).

On April 28, 1882, drove to the spruce brush; the country seems flooded with robins; the last mile of prairie, just before entering on the wooded and sand-hill region, was covered with an immense straggling flock. They were to be seen chiefly on the ground or making short flights. The general movement of the flock was northward. There must have been several thousands of birds in it.

On July 11, 1883, among the sand hills on the Portage Trail, I found a robin's nest; it was placed about 4 feet from the ground in a small isolated spruce, and contained three eggs which would have hatched within a week. This may have been a second brood.

Its song is first heard in the morning when the dawn is well advanced, the robin being more tardy to raise the matin song than many of his compeers. It is heard until the middle of the forenoon, then usually ceases until near sunset, when it recommences and continues until dusk. I have not yet noted this species singing by night. If when singing the bird be slightly startled by some noise close at hand, the loud cheery note is stopped, or at least altered, so that, although the song goes on, it is very faint and sounds as though coming from a great distance, and a close inspection will show the bird's bill to be shut. This was first pointed out to me by Dr. Brodie, but I have noted the same habit in several other species.

The loud rolling notes will remind Europeans of the voices of the Song Thrush and Blackbird, but there is a terminal bar of frequent occurrence that recalls the metallic notes of our own Wood Thrushes and reminds us of their near kinship to the Red-breasted Fifer (Toronto, 1885).

I have several times noticed that a nest containing young robins was lined with an inner coating of fibers, but can not say that this was added after the hatching of the young.

A friend informed me of a curious circumstance relative to a brood of this species. He had watched the old ones building in a silverbark or poplar, but shortly after the young were hatched he observed that the parents ceased to show themselves. After a little he climbed the tree and found in the nest the remains of the four young; nothing but the skins, all in shape with great staring eyes, but perfectly hollow and dried with the sun, while in and about them were hordes of ants, evidently the devourers if not the destroyers of the callow brood.

266. *Sialia sialis*. Bluebird. Blue Robin.

Rare summer resident; chiefly about the large towns. Winnipeg: Rare summer visitor (Hine). Red River Valley: Summer resident; tolerably common; noted a number of nests last year, 1884, inside city

limits (Hunter). North to Lake Winnipeg (Ridgway). Oak Point: 1885, first seen, one, on May 24; next seen May 25; is common and breeds here (Small). Portage la Prairie: Scarce; summer resident; a few pairs seen each summer; near Winnipeg quite common (Nash). Carberry: One record, a female with nest and eggs taken in the south sand hills by my brother, Dr. A. S. Thompson, June 8, 1886 (Thompson). In Minnesota: Abundant; breeds (Trippe).

May, 1884, Portage la Prairie: I have a single observation by Mr. C. W. Nash, which records the arrival of about forty bluebirds at this place at this time. They arrived in the gray dawn. Afterwards, in the day light, a second flock descended from the upper air and joined the first. Both flocks were of both sexes. One inference from this is that the spring migration is performed at night. In the fall the flocks are often to be seen flying by day, at a considerable elevation, while from time may be heard their warbling note, which, though it sounded so cheery in the springtime, now seems but a melancholy reminder that the time of the singing of the birds is past.

A recent arrival, but which seems likely to become abundant as it is increasing fast. The first I ever saw arrived in a small flock just at daylight, May 29, 1884. They hovered about for a time and then pitched down near my garden at Portage la Prairie. As this place is fortunately not infested with those pests, the bird collectors, they remained, and two pairs bred near me. These successfully carried off their broods.

May 22, 1885, more of them arrived and bred in the town.

May 3, 1886, quite a large flock arrived and spread themselves all over the place.

Near Winnipeg they are also now quite common, but I can not say when they first appeared there. I saw none in that district previous to 1885.

They depart early in October, my latest record being of October 3 (Nash, in MSS.)

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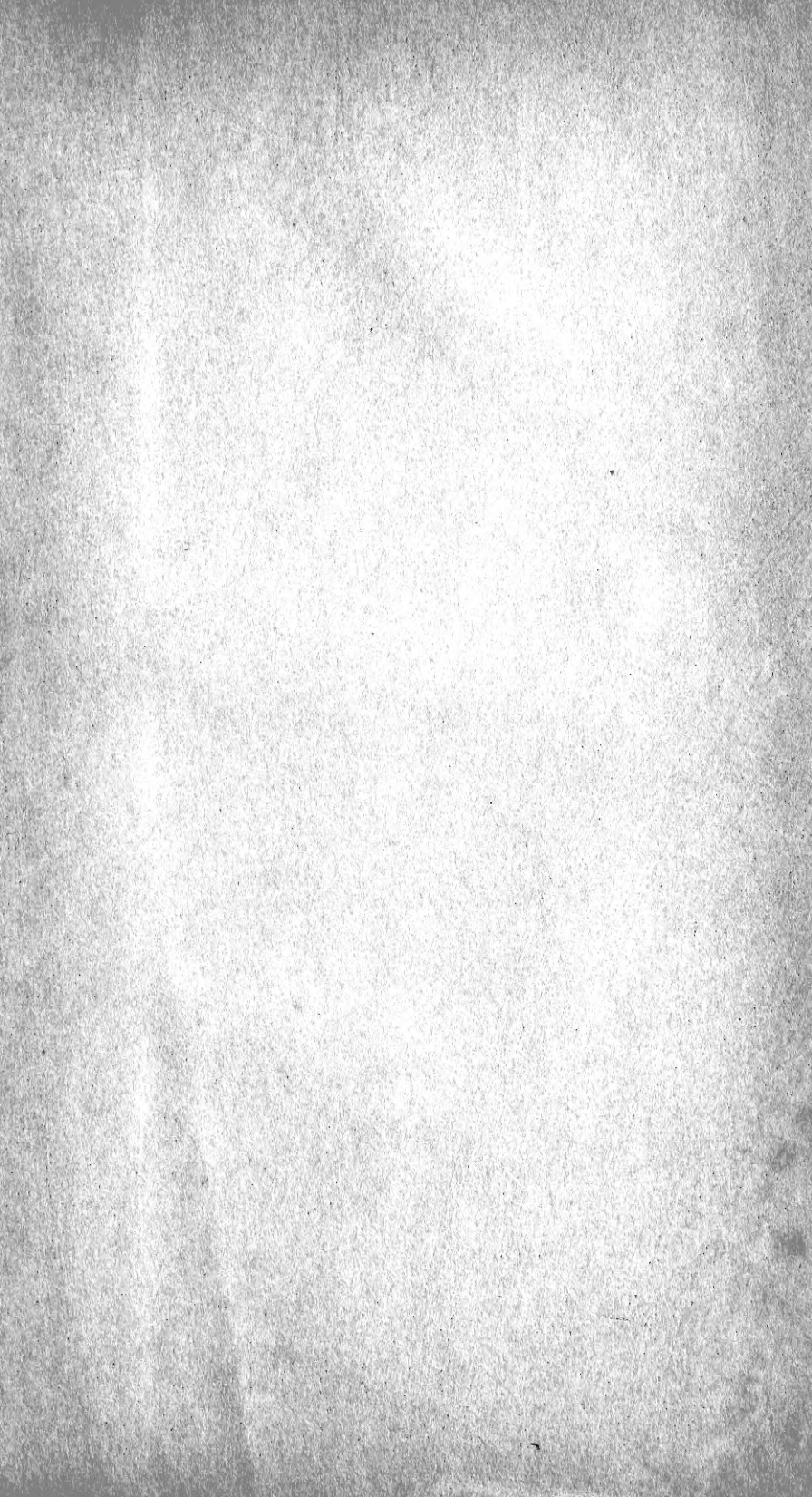
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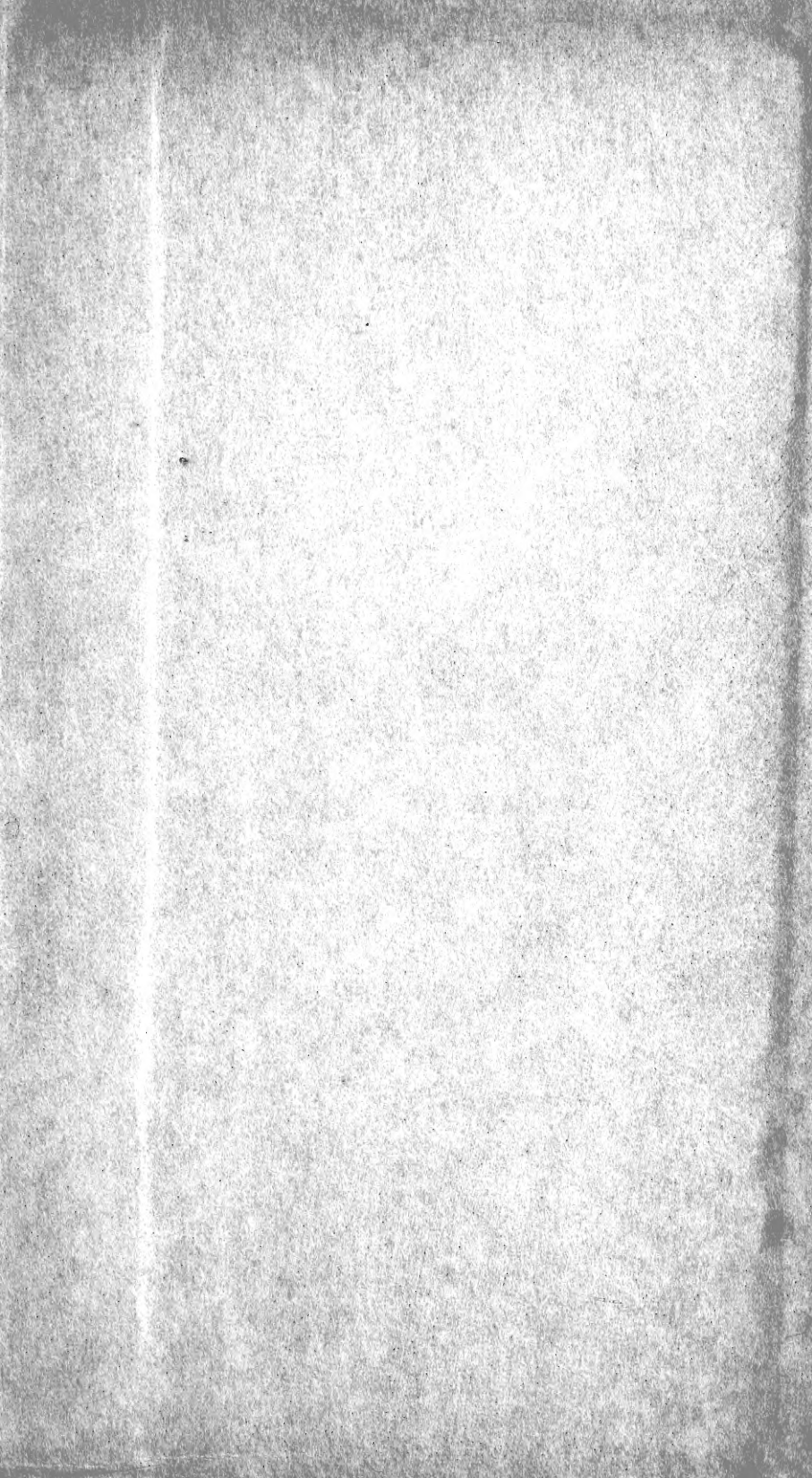
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